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Roy V. Wright, Editor
New York

C. B. Peck
Managing Editor, New York

E. L. Woodward
Western Editor, Chicago

Marion B. Richardson
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H. C. Wilcox
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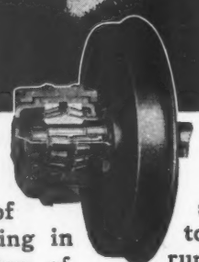
Timkens Tame Winter Terrors

Courtesy of General Electric Company



In pre-Timken days the approach of winter signified the coming of TROUBLE for railroads operating in northern zones—delays, disruption of train schedules—and worse.

But Timken Bearings have eliminated the source of many winter troubles by making car journals *winter-proof*.

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THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

Railway Mechanical Engineer

Founded in 1832 as the American Rail-Road Journal

Vol. 103 October, 1929 No. 10

Why the Need for Production?

SOMEONE once remarked that "when you don't know which way to turn it's a pretty good idea to stand still long enough to get your bearings." That would seem to be an excellent bit of advice to many railroad shop men when the subject of quantity production of car and locomotive parts is under consideration. Quantity production, or mass production as some call it, is a phase of shop operation that must be very carefully studied before being put into practice in order to make sure that it isn't overdone resulting in a loss instead of a profit.

This is probably what one of the speakers at the General Foreman's recent convention had in mind when, in discussing the subject of "mass" production, he raised the question, "Why the necessity for production?" and pointed out that in several cases with which he had come in contact the shop people had become so obsessed with the quantity output idea that they overlooked the fact that the parts which they wanted to produce in greater quantities were in reality being wasted. This speaker explained his position at length in raising the question in order that he might not be misunderstood and concluded his remarks by indicating that there is a real need in most cases for modern methods and machines to increase output but that railroad shop men must train themselves to know before they make a move what the real cost of the job is going to be.

The railroad shop of the future is going to be faced with the problem of turning out a higher grade of maintenance work on locomotives and cars, in greater quantities, as far as the finished repair job is concerned and at a lower unit cost per locomotive or car mile. Considering the fact that modern materials, modern facilities and labor cost considerably more than they did some few years ago it is not difficult to see that every mistake that is made in the operation of the shop today results in greater losses than once was the case.

We have suggested several times in these columns that possibly one of the reasons why many shop superintendents and general foremen do not get the new shop equipment they feel they need is because they fail to give their managements an intelligent reason for making the purchase. It might be worth while to ask themselves the question "Why the necessity for production?" the next time new equipment is being considered and the chances are that the analysis that will have to be made to answer this question will provide the best possible reason for the installation of modern equipment to replace the obsolete.

Increased Efficiency in One Operation Affects Others

IT is interesting to observe when studying figures pertaining to various items of maintenance costs, how an effort to obtain increased efficiency in one direction has frequently brought about improved performance in others. It is also interesting to observe that sometimes on first study many of the operations affected appear to have no direct relation to each other, although further study will show relationship. A superintendent of motive power made a drive some time ago to reduce the cost of lubrication. In one year's time, the cost of lubrication per 1,000 locomotive miles was reduced 21 per cent. During the same period, the mileage per set of cylinder packing was increased 1.6 per cent. This amounts to a considerable item, especially on a road which operates nearly 2,000 steam locomotives. It would appear that if an arbitrary reduction in lubrication should be carried too far, there would be an appreciable shortening of the life of all wearing parts, especially that of cylinder packing. It is apparent, however, that it was waste in lubricating material which was being eliminated rather than that necessary for proper lubrication.

Continuing the same line of thought, one might infer that an increase in mileage between renewals of cylinder packing would be effected at the expense of an increase in the consumption of locomotive fuel. However, during the period referred to, there was a decrease of 9.2 per cent in the amount of fuel consumed in freight locomotive service, and 9.3 per cent in passenger locomotive service. There was an increase of 3.4 per cent in switch engine service, but during the same time there was an increase of 4.4 per cent in cars handled in yards and terminals. There was a reduction of 5 per cent in coal consumed in mixed train service.

While these economies were being achieved, the superintendent of motive power found it possible to re-

duce the monthly appropriation for running repairs, and to increase the assigned mileage between classified repairs. He found that the assigned mileage between certain classified repairs was not sufficient inasmuch as the engine terminals were performing running repairs more efficiently. The superintendent of motive power attributes this general increase in the efficiency of his department to the drive initiated to reduce the cost of lubrication.

It doubtless appears to many mechanical department officers that, in paying close attention to one detail operation or to a single item among a multitude of responsibilities, one makes the mistake of allowing more important matters to drift. Doubtless such a policy would be a mistake. The fact that this superintendent of motive power observed the increased efficiency in other detail operations is evidence that he did not make this mistake. But by exercising the right kind of leadership he obtained the support of his entire organization. The movement, once started on this basis, did not stop with lubrication, but developed each new lead as it opened up. It was not the attention to a detail on the part of the superintendent of motive power, but the team work of an entire organization which was responsible for the results.

The Car Officers' Meeting

THE first and one of the most important fall meetings of railway mechanical officers in Chicago was that of the Master Car Builders' and Supervisors' Association, a report of which appears elsewhere in this issue. This convention, the first annual meeting of the new association, was notable for the excellent program of papers and reports prepared under the direction of C. J. Wymer, superintendent of the car department of the Chicago & Eastern Illinois, and chairman of the Program Committee.

High points of the proceedings included addresses by T. W. Demarest, general superintendent of motive power of the Pennsylvania, Western Region, and Dr. Samuel N. Stevens, professor of psychology, Northwestern University. Mr. Demarest urged strongly the periodical maintenance of freight cars, a subject which probably will engage the attention of car department officers to an increasing extent as time goes on. Doctor Stevens gave his remarks regarding the psychology of handling men an intensely practical term, maintaining that individual characteristics must be studied in any attempt to secure maximum over-all efficiency of a group, and citing many instances to show that material incentives alone cannot produce the desired results. From the interest with which this subject was received, it should unquestionably appear more often on railroad convention programs, and the Master Car Builders' and Supervisors' Association is to be commended for thus giving consideration to the most important single problem confronting railroad officers.

By the concerted action of an active membership committee of which K. F. Nystrom, superintendent of the car department of the Chicago, Milwaukee, St. Paul & Pacific, was chairman, the association membership has grown to a total of 1,600, and some idea of the scope and future possibilities of the association may be gained from the statement on the floor of the convention that the membership goal should be not 1,600 but 16,000. Possibly this goal may never be reached, but every evidence points to the conclusion that the Master Car Builders' and Supervisors' Association is destined to attain a large membership of representative car department officers throughout the country and prove an important influence for good in car department matters.

Of the many associations in the railway field which must justify their existence by the quality of service rendered, it may be safely said that no one has a better chance for success than the Master Car Builders' and Supervisors' Association, providing its development is guided along the lines planned by its present officers and board of directors. In itself an amalgamation of two former groups of car men, the new association is the only national body with membership limited strictly to representative railway car department officers and supervisors. This membership of specialists will bring a wide experience and national viewpoint to the consideration of general car-department and car-shop problems, as well as interchange and loading rules, which may be made to supplement effectively the work of the A. R. A. Mechanical Division. An organization with the membership and program of the Master Car Builders' and Supervisors' Association is an invaluable agency for promoting general progress and increased efficiency in the car department.

Draft-Gear Maintenance

THERE are two aspects of the draft gear situation which always present themselves for consideration in any discussion of equipment conditions as affected by draft-gear service. One of these pertains to the operating characteristics of the draft gear; the other pertains to its maintenance. Until recently by far the greater attention has been given to the former and, even yet the importance of the latter does not seem to have been at all generally recognized. In the vast amount of work which has been done in studying the characteristics of draft gears and in rating the gears of different designs with respect to certain measurable characteristics, the basic purpose has been to bring about the development of the ideal draft gear so far as the ideal is possible of attainment within present limitations of pocket spacing and travel.

As yet there does not appear to be much likelihood of arriving at a general agreement as to what constitutes the ideal draft gear—much less of actually attaining it. Many of those who have to deal with the subject place more stress on the durability of the draft gear itself than on the protection it will offer to the car and its lading. There are railroad officers who even believe that a draft gear should be sold under a guarantee of more years of service than may be expected of the car itself without a considerable amount of repair work. Others believe that the protection of the car is the paramount consideration and that the durability of the draft gear itself should be subordinate to this consideration; hence, while it is entirely possible to give draft gears laboratory ratings as to absorption and recoil, and sturdiness, the meaning of these ratings in terms of service value is still open to several interpretations.

In the meantime cars must be operated with existing types of draft gears and while future improvements in draft-gear design should certainly be encouraged, they offer no opportunity now or in the immediate future for reducing car maintenance costs and damage claims resulting from poor car protection. The immediate op-

portunities all lie in the maintenance of existing draft gears so that they may function effectively not only while they are new but continuously during their entire service life.

Some railroads have already undertaken the systematic and periodical inspection and maintenance of draft gears and, as far as we know, where this work has been done effectively the results have thoroughly justified it in the opinion of the responsible officers. It is encouraging to find that appreciation of the importance of some such scheme of draft gear maintenance is spreading. A committee of the International Railway General Foremen's Association, in its report on this subject, says: "It is the opinion of your committee that a large saving can be effected if some feasible inspection period can be determined by the railroads and private car owners."

On the committee's recommendation the association has decided to request the Mechanical Division, American Railway Association, to consider the development of a draft-gear inspection rule similar in principle to the rule on journal repacking which becomes effective January 1, 1930. Until within the past two or three years the draft gear has been so universally neglected in service that relatively little experience is available on which to fix the duration of the time between inspections. It may, therefore, require several years before the members of the Mechanical Division can be brought into agreement on the provisions of such a rule. Until general practice can be brought into conformity with a rule of this kind, however, the best and most economical draft gear service will not be attained.

Standard Specifications

DR. Charles E. Skinner, past chairman of the American Engineering Standards Committee, member of the National Research Council and assistant director of engineering of the Westinghouse Electric & Manufacturing Company, in an address before the Pacific Railway Club, paid a fine tribute to Dr. Dudley, late chief chemist of the Pennsylvania, when he gave him the credit for early instilling the idea that a specification for a material is never satisfactory to the user of the material until it is satisfactory to the supplier. Dr. Dudley's work is something of which the railroad industry may be proud, especially during the time that he was president of the American Society of Testing Materials. "His addresses as president of that society," said Dr. Skinner, "are the bible, you might say, of the specification makers of this country."

The railroad industry occupies a very different position with respect to research from that of the manufacturing industries. This point was stressed by Dr. Skinner in his references to Dr. Dudley's work. The manufacturers build their business to a very considerable extent on the control of their patents. The railroads are almost free from that restriction, and the research which they can undertake need not be tied up with the patents. Furthermore, the results of the research laboratories of the world are more or less available to the railroads for their use and application.

The object of the manufacturers engaging in research is to better their own product.

The major advances in materials used by the railroad have largely come from the laboratories of manufacturers. The result of these researches are available to the railroads and they have been extensively used by the various specification committees of the American Railway Association, and also the American Society for Testing Materials, and other interested technical societies.

Considerable has been done in the last few years toward the development of alloy and heat-treated steels in the construction of locomotives. Most of this has been done by manufacturers working in conjunction with one or two railroads. There is no doubt but that alloy and heat-treated steels will be more extensively used in locomotive construction as the results of this research prove satisfactory. Specifications for such materials for various locomotive parts have already been prepared for a number of individual roads and are constantly being revised as development work progresses. The preparation of these specifications is being done largely by the individual railroads and co-operating manufacturers. It has been suggested that the A. R. A. Committee on Specifications and Tests for Materials should make it one of its functions to observe and study the results of the research and experimental work that is now going on to develop new materials for locomotive construction, with the object of developing recommended specifications before the materials get into general use, and a number of railroads have written specifications of their own.

Individual railroads could perform a real service to the industry by inviting the co-operation of this committee in the preparation of specifications which are the result of individual development and experimentation. If such a liaison could be established, it should go a long way toward eliminating such situations as that described in an editorial published in the December, 1928, *Railway Mechanical Engineer,* relative to specifications for car journal-bearing metals, for which 65 different railroads have their own specifications differing from the A. R. A. standard.

Manufacturers certainly have a right to object to such a large number of specifications for material that is used for one purpose. Dr. Skinner's reference to the advice given by Dr. Dudley, that specifications must be satisfactory to both user and manufacturer, is timely. Standard specifications are certainly more satisfactory to both parties than a large number of independently developed specifications, most of which contain only slight variations. These slight differences are irritating and in many ways costly to the manufacturers.

New Books

A DIRECTORY OF RESEARCH ON HEAT TRANSMISSION. *Compiled by the Committee on Heat Transmission, Division of Engineering and Industrial Research, National Research Council, 40 West Fortieth street, New York. 30 pages, paper bound.*

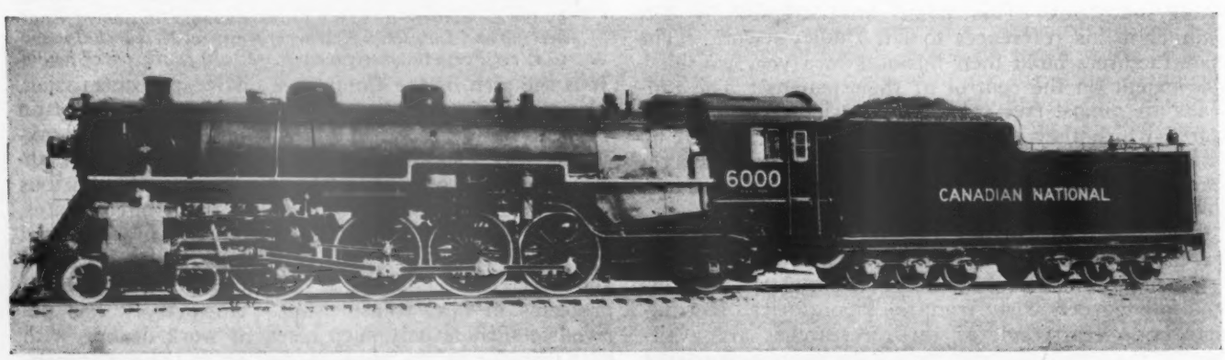
It is the plan of the Committee on Heat Transmission, National Research Council, to revise this directory on research of heat transmission at intervals of approximately six months. The directory contains brief abstracts of the scope of work in progress in the various educational institutions throughout the United States. The committee realizes that there are many technical investigations in the fields of metallurgy, mechanical and electrical engineering, which involve important problems in heat transmission. However, it has decided to include only such research work dealing with heat transfer as are being carried on in the experimental stations of various educational institutions.

Canadian National oil-electric locomotive No. 9000 hauling a passenger train

Canadian National's 2,660-Hp. Oil-Electric Locomotive

Demonstration run made with eight-car train—Two units equipped with 12-cylinder, V-type engines

A PUBLIC demonstration of the performance of the Canadian National Diesel electric locomotive No. 9,000, under actual operating conditions was given on August 26, 1929 when a special passenger train running as a second section of the International Limited was run from Montreal, Que., to Toronto, Ont. The train consisted of a combination baggage and smoking car, a day-coach, three solarium type club-observation cars and two business cars, weighing about 663¼ tons. The party consisted of representatives of the press from both the United States and Canada, officers of the Canadian National Railways, representatives from several railways in the United States, representatives of companies having a part in the design or construction of the locomotive—The Westinghouse Electric and Manufacturing Company, The Baldwin



The steam locomotive with which the tractive characteristics of the No. 9000 are compared

Locomotive Works, The Canadian Westinghouse Company and The Canadian Locomotive Company—and the mayors and presidents of the boards of trade of Montreal and of the communities at which the International Limited makes schedule stops.

The International Limited leaves Montreal at 10:00 A.M., eastern standard time, and arrives at Toronto at 5:40 P.M. after making 13 intermediate stops. The demonstration train was scheduled to leave Montreal 30 minutes behind the first section and to make the regular running time of the limited and all its schedule stops.

The schedule calls for a run of 334 miles from Montreal to Toronto in seven hours and forty minutes with an average speed, including the 13 intermediate stops,

Front of oil-electric locomotive No. 9000

of 43.6 miles an hour. The locomotive had no difficulty in making the trip in running time. At several points on the run, owing to delays at stations where stops were made, the train left from 2 to 13 minutes behind the schedule. With its 663-ton train, however, there was apparently no difficulty in making up time following any of these delays and the 334 mile run was completed in the schedule time of seven hours and forty minutes.

Largest Locomotive of Its Kind

This locomotive, the largest and most powerful of its kind, made its first appearance in just a little over three years after the first oil-electric rail car of 200-hp. rating was installed on the lines of the same system. It consists of two units, and weighs 650,000 lb. when fully equipped, of which 480,000 lb. is carried on the driving wheels. Each unit consists essentially of an engine-generator set mounted on the locomotive frame, boiler equipment for steam heating of passenger coaches, four traction motors for propelling the locomotive, air-brake and other auxiliary equipment.

The power developed by the oil engine is converted into electrical energy by the generator and transmitted to the traction motors geared to the driving axles. With the present gear ratio, which was laid out for high-speed passenger service, the locomotive will develop a tractive force of 100,000 lb. during accelerating periods and 42,000 lb. continuously. The electrical system of transmission utilizes approximately the full engine horsepower over a wide range of speed and tractive force of the locomotive in either direction without change of engine speed or shifting of gears.

The operation of the locomotive and the speed of the oil engine are controlled from either of two engineman's stations, which are located in separate compartments at the outer end of each unit. Means are provided for the control of both units jointly, or either unit independently of the other unit, from these stations. Gages are mounted at each engineman's station for indicating the operation of each unit.

Twelve-Cylinder Oil Engines

Each unit contains a Beardmore twelve-cylinder oil engine of the solid-injection type, with cylinders of 12-in. bore and 12-in. stroke. The nominal rating of the engine is 1,330 hp. at 800 r.p.m. The engine is of the variable speed type, and may be run at any speed between idling speed at 300 r.p.m. and full speed at 800 r.p.m., the engine governor controlling the throttle to maintain the speed corresponding to the governor setting. A fractional-horsepower electric motor, controlled from the engineman's station, is used for changing the speed setting of the governor. The engine develops its rated horsepower at a fuel rate of .43 lb. per b. hp. hr. It will develop reduced power as may be required in locomotive service with but a slight increase in the fuel rate. The engine is started from standstill by power taken from a storage battery on the locomotive using the main generator as a motor. The oil engines were designed and supplied by the William Beardmore Company, Glasgow, Scotland.

The cooling of the oil engine is accomplished by circulating the engine jacket water through radiators of the honeycomb type mounted on the locomotive roof. The lubricating oil is circulated through tubular finned radiators, which are also mounted on the locomotive roof. Both sets of radiators are force ventilated by motor-driven blowers of the propeller type, although the natural ventilation resulting from the locomotive speed will be sufficient to cool the engine during cold weather, and will assist materially in cooling it at other times. The radiator blower motors are controlled by separate thermostats placed in the water and oil to maintain desirable operating temperatures for each. Means are provided for bypassing a part or all of the water during initial warming up periods.

Comparison With 4-8-2 Type Steam Locomotive

The outstanding characteristic of the oil-electric type of traction is the ability to utilize practically the full rated horsepower of the prime mover at all speeds within the operating range of the locomotive. This results in the ability to develop draw-bar pulls at starting and slow speeds which are limited only by the adhesion of the driving wheels and by the temperature rating of the electrical machinery. One of the illustrations shows a comparison of the tractive-force curve of the No. 9000 with that of Canadian National Moun-

tain type locomotive No. 6000. A comparison of selected dimensions and data pertaining to these two locomotives is shown in the table.

It will be seen that at speeds below 20 miles an hour, the tractive capacity of the oil-electric locomotive is materially in excess of that of the steam locomotive, while at speeds greater than 20 miles an hour the tractive force of the steam locomotive slightly exceeds that of the oil-electric locomotive, the two curves, however, remaining approximately parallel at speeds above 30 miles an hour.

The advantage of the high tractive force at starting and at slow speeds was evident in the rapidity with which the locomotive was able to accelerate the train during the demonstration trip. General observations indicate that locomotive No. 9000 will bring a train of this weight up to a speed of 60 miles an hour in about one-half the time required by steam locomotives similar to No. 6000. Based on voltmeter and ammeter reading, the maximum combined horsepower output of the two Diesel engines did not exceed 2,100 hp. at speeds of 60 miles an hour or higher. At speeds up to 45 miles an hour, however, when handling the train up ascending grades, the engines developed between 2,500 and 2,600 hp. for several minutes at a time. In starting and accelerating the train the full horsepower rating of the engines was developed for short periods. On one occasion the train attained a maximum speed of 73 miles an hour, which was sustained for a short time, with a power output of approximately 1,800 hp. Speeds of 60 to 65 miles an hour were frequently reached and maintained for considerable periods.

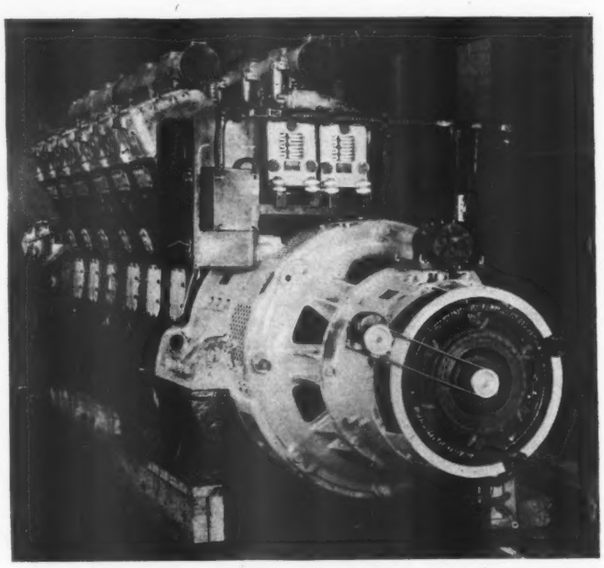
During the demonstration trip the exhaust from the engine of the rear unit showed a brown haze both while idling and while developing full engine speed. The exhaust from the engine of the front unit while visible, was considerably less noticeable.

Exhaust Heat Aids Oil-Fired Boiler to Heat Train

The exhaust gases of the oil engine are conducted to an economizing boiler located in the cab, and finally discharged to the atmosphere at a reduced temperature. The economizing boiler also serves as an effective silencer in muffling the exhaust of the engine. The heat saving in the exhaust gas is sufficient to heat a passenger train of an average number of cars for outside temperatures as low as 12 deg. F. below zero with the oil engines operating at average loads, and for lower temperatures with the oil engines operating at full load. The heat saving effected by the economizing boiler results in a substantial increase in thermal efficiency of the locomotive.

An oil-fired boiler has been installed in each unit which will operate in conjunction with the economizing boiler to supply steam for train heating during periods when the output of the latter does not meet the requirements. This boiler uses the same fuel oil as the engine, and it has an evaporative capacity of 2,500 lb. of steam per hour to 100 lb. pressure. It is controlled automatically to maintain a constant pressure in the train heating system with the varying rates of evaporation of the economizing boiler. The automatic operation is accomplished by a pressure controller, which operates to increase the supply of fuel oil, atomizing air or steam, and combustion air, if the pressure falls below normal due to a reduced output from the economizer, corresponding with a reduced load on the oil engine, and conversely to reduce the supply of fuel oil, atomizing air or steam, and combustion air, when the pressure increases above normal due to an increased supply of steam from the economizer, corresponding with the increased load on the oil engine.

Automatic control of water injection pumps for both economizer and oil fired boiler is provided to maintain the water at constant level in both boilers during periods when the demand for steam requires full output of the former and partial or full output of the latter. When the demand for steam is less than the capacity of the economizer, the oil-fired boiler may be made inoperative and the output from the economizer reduced by lowering its water level, thereby reducing the evaporative rate. Under these conditions, the water level and consequently the evaporative rate of the economizer is



The Beardmore 12-cylinder V-type solid injection oil engine —Develops 1,330 hp. at 800 r.p.m.

controlled automatically by a pressure controller which operates to control the water-injection pump. Under conditions where there is no demand for steam, the water level is reduced to zero and the economizer is operated dry as a silencer for the oil engine until such time as a demand for steam occurs, when water is injected into the economizer and it again functions as a boiler.

The economizer and boiler are of the thimble tube type, and were designed and furnished with the auxiliary steam-control equipment by the Clarkson Steam Motors Company, Ltd., London, England.

The electric generators, motors and auxiliary electrical equipment were designed for this particular service by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa. and were supplied by the Canadian Westinghouse Company, Hamilton, Ont. The system of control provides for varying the speed of the oil engine and generator voltage, and shunting the field of the series type traction motors for changing the speed of the locomotive.

A lead storage battery consisting of 56 cells of Exide M.V.A. 21, 340-ampere-hour capacity, is carried on each unit. This battery is used for engine starting and also furnishes power for control, lights, and auxiliaries. It is charged from the main generator during engine idling periods and from the auxiliary generator during power periods.

The locomotive is equipped with Westinghouse 14-EL air-brake equipment, transfer valve, and brake valve pedestal. Each unit of the locomotive has a 75-ft. motor-driven air compressor which operates from the main generator during engine idling periods and from the auxiliary generator during power periods, thus insuring full speed under practically all operating conditions. Automatic means are provided to prevent application of power on reversal of the locomotive with the driver brakes applied.

The foundation brake rigging, designed and supplied by the American Brake Company, St. Louis, Mo., represents the maximum in simplicity and flexibility for this type of chassis. Four driver brake cylinders are provided for each unit, two of which brake the two forward pairs of drivers, while the other two brake the two rear pairs of drivers. A fifth brake cylinder is provided for braking the four-wheel engine truck. A hand brake is also provided for holding the locomotive when stopped, in case the air brake is inoperative.

Mechanical Design

The main frame of each unit consists of a Commonwealth casting having supports for the oil engine bed-

Selected Data and Dimensions of Canadian National Oil-Electric and 4-8-2 Type Steam Locomotives

	Oil Electric Locomotive No. 9000	Steam Locomotive No. 6000
Total weight	668,000 lb.	*594,860 lb.
Weight on drivers	461,904 lb.	231,370 lb.
Number of driving wheels	16	8
Diameter of drivers	51 in.	73 in.
Engines	2 1330-hp. Beardmore: Oil Engine	
Generators	2 Westinghouse No. 478	
Auxiliary generators	2 Westinghouse YG-8	
Motors	8 Westinghouse No. 359 Railway	
Gear ratio	22:69	
Evaporative heating surface		4,049 sq. ft.
Superheating Surface		810 sq. ft.
Grate area		66.7 sq. ft.
Cylinders		26 in. by 30 in.
Steam pressure		210 lb.
Maximum tractive force	100,000 lb.	49,600 lb.
Sustained tractive force	42,000 lb.	

*Including tender.

plate, boiler supporting casting, cab brackets, air duct, brake hangars and equalizer pins cast integral with the side frame and crossties. The four-wheel and two-wheel truck frame are also of the Commonwealth type. The driver journals and two-wheel truck journals are waste packed, oil lubricated. The four-wheel truck journals are of the outside bearing type with floating bushing, grease lubricated. The equalization system consists of one point of support at the centre pin of the four-wheel truck, and one point in the equalization system of each side, the drivers being side equalized with the two-wheel truck.

The mechanical design of the locomotive represents the result of the combined efforts of the Canadian National Railways, Canadian Locomotive Company, Baldwin Locomotive Works, Commonwealth and Westinghouse Electric & Manufacturing Company.

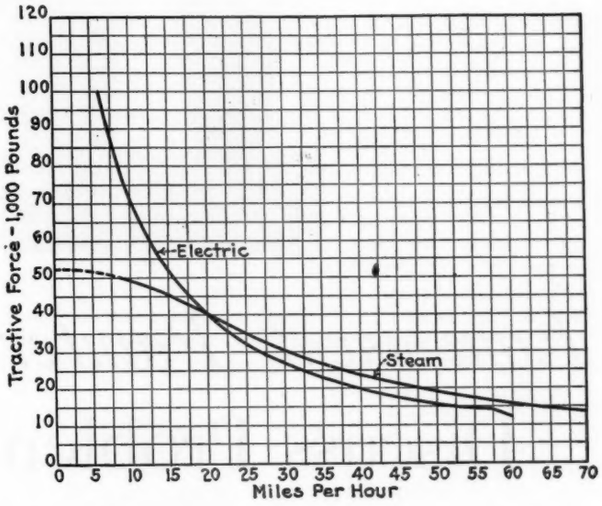
Each unit carries approximately 8,000 lb. of fuel oil, 11,000 lb. of boiler water, 3,000 lb. of engine jacket cooling water, 3,000 lb. of sand, and 1,000 lb. of engine lubricating oil.

Fuel for Twelve Hour Operation

The supply of fuel oil will be sufficient for operation of oil engine and oil-fired boiler, operating under average conditions, for twelve hours. A motor driven pump is mounted on each unit for filling fuel oil tanks. An oil filling pipe is installed on the locomotive for filling either unit from a tank car at the end of the locomotive.

The engines have a nominal fuel rate of .43 lb. of oil per brake hp.-hr. operating at their rated output. The fuel oil costs the railroad approximately five cents per U. S. gallon which, with coal averaging approximately $5 a ton on the tender, gives a fuel cost approximately one-third of that of coal on a gross ton-mile or a passenger car-mile basis.

The first unit of the locomotive has been in various classes of service since its delivery late in 1928. The



Comparative tractive force curves of Canadian National 4-8-2 type steam locomotive No. 6000 and oil-electric locomotive No. 9000

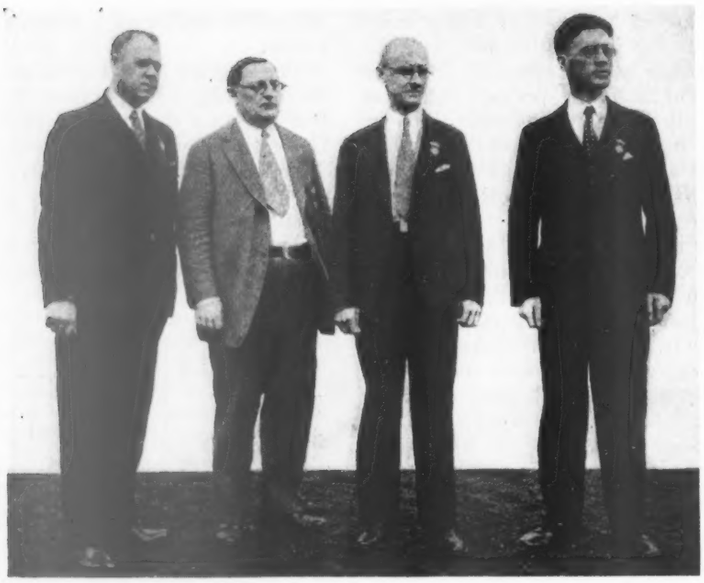
completed double unit will be operated in various services at various points on the Canadian National system for some time before being assigned permanently to any service in order that the railroad may determine its adaptability for service under a wide variety of conditions. It is also planned some time within the next few months to operate the locomotive on a continuous run from Montreal to the Pacific coast.

Performance in Freight Service

With the present gear ratio in freight service, the tonnage which can be handled will depend upon the ruling grade and is limited by the heating of the electric equipment. Assuming a ruling grade of 0.4 per cent, it will handle trains of 2,800 tons made up of 45-ton cars, under average weather conditions, at a speed of approximately 19 m.p.h. on this grade, with a balancing speed of approximately 40 m.p.h. on level track.

Assuming a freight gear ratio of 18:73, the locomotive will be capable of developing a maximum tractive force of 130,000 lb. during accelerating periods with momentary tractive forces limited by adhesion. It will handle a trailing load of 3,700 tons, made up of 45-ton cars, under average weather conditions, on a ruling grade of 0.4 per cent at approximately 15 m.p.h. and it will have a balancing speed of approximately 35 m.p.h. on level track.

The oil engines of both units are arranged for the future application of a supercharger, one of which was built and tested on both engines soon after the locomotive was first placed in service.



New Officers—Left to right: K. J. Johnson (N. C. & St. L.), first vice-chairman; V. R. Hawthorne (secretary, Mechanical Division, A. R. A.); Marceau Thierry (N. & W.), chairman; E. M. O'Brien (Illinois Central), second vice chairman

Equipment Painters Discuss Problems at Kansas City

Research improves materials and practices— Lacquer now recommended as most desirable railway finish

THE eighth annual meeting of the Equipment Painting Section, Mechanical Division, American Railway Association, was held at the Hotel Muehlebach, Kansas City, Mo., September 10 to 12, 1929. This meeting, with a total attendance of 330 members, guests and supply men, was also the fifty-ninth anniversary of the organization of the former Master Car and Locomotive Painters Association in 1870.

On the opening day of the convention an address was made by E. R. Cott, supervisor of safety, Hocking Valley, and an individual paper on the value of Research to a Railway Paint Shop was presented by W. J. Miskella of the Finishing Research Laboratories, Chicago. At the second day's session an individual paper was presented on the subject of "Aluminum Paint in the Transportation Industry," by H. W. Ostrum of the Aluminum Company of America.

One noticeable feature of this year's meeting was the absence of any discussion on the question of the use of lacquer for cars and locomotives. In fact, contrary to several previous meetings the aversion to the use of lacquer seems to have disappeared and the report of the committee on new developments in painting includes the statement that "lacquer is one of the most desirable finishes that can be applied to passenger-car equipment, both interior and exterior." That the application of lacquer, or more broadly speaking the application of any finishing materials by the spray method, still presents a problem as far as the railroad shop is concerned is indicated by the fact that the report of the Committee on Shop Construction and Equipment included reference to the necessity of equipping car shops with adequate ventilating systems for use with spray-painting equipment.

This year's report of the committee on Tests was probably one of the most comprehensive reports of its kind ever presented to the section. Its great length and detail prohibit its complete reproduction here.

Election of Officers

The following officers were elected to serve for the year ending September, 1930: Chairman, Marceau Thierry, foreman painter, Norfolk & Western, Roanoke, Va.; first vice-chairman, K. J. Johnson, foreman painter, Nashville, Chattanooga & St. Louis, Nashville, Tenn.; second vice-chairman, E. M. O'Brien, foreman painter, Illinois Central, Chicago.

The following members were elected to serve on the committee of Direction for a like period: A. E. Green, foreman painter, Chicago & North Western, Chicago; James Gratton, general foreman painter, Buffalo, Rochester & Pittsburgh, Du Bois, Pa.; B. E. Miller, master painter, Delaware, Lackawanna & Western,

Kingsland, N. J.; H. Hengeveld, master painter, Atlantic Coast Line, Waycross, Ga.; J. W. Gibbons, general foreman car department, Atchison, Topeka & Santa Fe, Topeka, Kan., and E. W. Grimminger, foreman painter, Pennsylvania, Altoona, Pa.; L. B. Jensen, O. M. St. P. & P. and D. C. Sherwood, the retiring chairman of the Equipment Painting Section who has been appointed chairman of the committee. The Equipment Painting Section voted to hold its 1930 meeting at Chicago.

The Value of Research to a Railway Paint Shop

By William J. Miskella, M. E.
Director, Finishing Research Laboratories, Inc., Chicago

Mass production—that is the keynote of the present day. To it may be traced every modern activity, whether it be automobiles, radios, chain stores, foods, clothing or what not. This keynote has taken the place of all the old secret-process procedures and undercover work that used to be so common. Today, practically everything of a manufacturing nature is done in a free, open and above-board fashion.

The fact that you gentlemen are assembled here in this convention to openly exchange ideas and do all you can to aid each other is the best argument in the world that the new order of things is the better one. Your work is out of the secret class, but not quite in the mass-production class. Anyway, it is better to be looking forward than backward and so we will imagine just for fun that each one of you will be directed by your superior when you get back home to prepare to increase production to thirty cars per day without increasing your floorspace! Of course, that is not likely to happen with the earnings of railways as they are—not even under individual ownership! Naturally, this new order of things could not become a reality for some time because of the radical departure from present routine. Therefore, let us suppose that three years time is to be allowed in which to put this new plan in operation and let us see what some of the obstacles are and what we might expect in the way of a final plan.

First, you would have to be sure of every move as there would be no long profit to cover up any errors that might be made. Naturally, you would have to do things in a production way—in a modern way, if you please. Every little detail would have to be watched for possible changes toward improvements. Today, even if you happen to put the wrong color on a car, a little varnish remover or some lacquer thinner soon corrects the mistake and no one is the wiser. It wouldn't be so easy though if you were finishing thirty cars per day on a line conveyor at such a rate that a dozen cars would be coated in error before the mistake was discovered.

The Value of a Chemist

Suppose, for example, a group of cars came down the line to the finishing department and they were all gummed up—I mean that literally—all covered with wads of chewing gum for the painter to remove. Putty knives might help. Rotary grinders certainly would not solve the problem. Where would you go to find out the best method to quickly remove the chewing gum? Perhaps you would put it up to your present chemical department—the members of which specialize in water treatment and steel work, but who know little about paints and lacquers. Perhaps some industrious workman would find that a hot flat iron applied over a blotter would reduce the size of the obstruction. Finally, though, you would throw your hands up in disgust and exclaim—"If I only had a chemist familiar with paints and lacquers under my direct jurisdiction, he could tell me something that would dissolve this!" Indeed, that would be fine, and likely he would tell you to use some hot carbon tetrachloride.

From this rather primitive example, it will be seen that the knowledge for the quick and best solution of production problems is not a part of your makeup—and that is no criticism. One does not have to stretch his imagination very far to realize that the chemist, even if he were available in the paint-shop organization, would be greatly handicapped on account of the lack of an unlimited variety of chemical and physical testing instruments.

And so, a chemist would be needed to solve this difficulty, and an engineer to solve that one and before long there would be quite an elaborate technical staff in your shop. However, there would be other and more important things for this technical force, such as, for example, to determine the composition of a paint, varnish or lacquer so as to be able to predetermine weather resisting and other physical characteristics; the fastest practical way to accelerate drying; the simplest way to match accurately a standard color; the surest way to eliminate failures due to fading, chipping, peeling, cracking, discoloration, orange-peel, spray-gun streaking, how to make finishes stick to rust - proofed surfaces, the effect of cheap thinners containing petroleum distillates upon the low viscosity cotton used in modern lacquer, the reason for the rapid deterioration of transparent lacquers when exposed to the weather.

D. C. Sherwood (N.Y.C.) Chairman

You would encounter fume-exhaust problems; there would be a demand for developing special processes of application outside of the three common ones — spray, brush and dip. You would find it necessary to see that the cars came to you perfectly clean and free from rust and various results of oxidation. There would have to be a separate pressure container for each color used—no more changing from one color to another in order to "get by" with one spray outfit.

You wouldn't have to wait until you got to the next annual convention to ask some brother master painter if he had tried out wet or dry sand-paper, masking tape, chromium plating, spray shield, pressure handling of finishing materials from a central storage plant, air-motor-driven agitators, emulsified asphalt, scaling hammers or rotary polishing machines. You wouldn't have to be a party to raising the cost of the various things you buy by making the salesman call on you a dozen times before he arouses your interest well enough to get you to say "I'll try it."

The use of the spray-gun in railway car finishing, exclusive of freight cars, is a beautiful example of this. Each one of you can think back a few years and recall just when you started to use the modern spray-gun and

lacquer—it wasn't very long ago—very few can say that they have been using this modern method inside the shop for five years. Yet, the automobile industry could testify to the use of the spray-gun for twenty years and to the use of lacquer for nearly seven years.

Let us see how our imaginary 30-car production railway finishing shop is getting on after a lot of the minor things that are always experienced at the beginning are settled and after things have calmed down to normal. We find the master painter installed in a private office, surrounded with a plate glass partition. The panels in this partition, by the way, have been decorated mechanically with bouquets of roses cut in with fine silica sand by means of a modern sand-blast pistol. Incidentally, too, the work was done in the company's new car-cleaning department.

Problem for the Research Laboratory

As we stand there awaiting the opportunity to grasp the hand of a happy finishing department manager, we hear him dictating a letter to the research laboratory—in which all the processes, materials, and equipment are designed, tested, tried out and approved before they reach the painting and lacquering department. The letter in question is in reply to a letter asking for an opinion covering a proposed method of applying multicolored modernistic triangles that are to be used in next year's model of railway car.

One of the equipment items in this research laboratory, which is the largest and most complete of its kind in existence, is worthy of note. It is an accelerated weathering machine that has taken the place of all the old-fashioned methods of weathering actual panels in outside exposure tests. This machine is built around the old carbon arc of our boyhood days and furnishes artificial sunlight, wind, rain, humidity, cold, heat, sand abrasions, salt atmosphere and any other local conditions that may exist. It carries standard panels 8 inches by 3 three inches and instead of waiting two years for the outside exposure tests of the old days to detect physical weaknesses, sample panels are made of the various materials under test. The method of selection by comparison of accelerated test panels has been adopted to take the place of the older and less reliable method. It is interesting to note that the results of these accelerated tests are available in 17 days after the comparative test is started.

One of the departments in this research laboratory contains a number of miniature working models of various methods of exhaust and means for studying the ventilation and other designing factors developed from actual use from the railway point of view. A new idea that has just been placed on the market consists of an overhead canopy which leaves the floor free for the movement of cars and for unhampered finishing operations. This is very novel and consists of an overhead exhaust system which pulls out the fumes that are entrapped in a vertical air curtain created by a blower type fan which is concealed in the floor and which pushes the air upward through a narrow slot in the floor. Here is an example of a piece of equipment which has been developed by an industrial company to fulfill the needs of the railway shop as the conditions are recognized from the outside. The object of the miniature working laboratory model is to study the new idea and try to improve upon it so that it may better serve the master painter, whose problems are intimately known by those in charge.

In another corner of this laboratory is a section used for the study of sandpapers. A sandpaper manufacturer has convinced the purchasing department and several of the other interested officials in the use of silicon carbide crystal paper as a substitute for ordinary sandpaper and has submitted a chunk of the raw material used in making the waterproof grade. The engineers in the laboratory are skeptical and have placed some of the number 120 crystals under a high-powered microscope which magnifies them 40 times. They will continue this study by examining the finished sandpaper as well as samples of some that have been used for some time. Indeed, they may possibly recommend to the master painter a cleaning method whereby more life may be gotten out of the pieces that have become clogged from use, but still have very sharp and useful edges on the silicon carbide crystals.

In still another corner, there is the new color analyzer which removes the personal element from color matching and tells scientifically just what is needed to make a color match a standard sample or how to make a color that will exactly duplicate another color. This instrument is a combination of a standardized source of light, a rotating disc photometer and a constant deviation spectrometer. It has a very wide field in the finishing department in the matching of dyes, oils, varnishes, lacquers, etc., whether pigmented or clear.

We hear much today about research and the remarkable things that it is doing. Radio, the talkie and even the automobile as we have it delivered to us lately would never be possible were it not for the combined research efforts of many chemists, physicists and engineers of various kinds. It is a noticeable fact, though, that research seems to stop as soon as a manufacturer delivers a product, such as a paint or a lacquer, to a customer. Therefore, it is necessary for some one to take up the task from this point on and apply research principles to application and processes of handling so that in the end the full value of all modern developments in chemistry, physics and other sciences will be incorporated in the product, whether it be a tack or a railway passenger car.

There is a very interesting relation between railway finishing and great industrial fields and that is participation in the advancement that is made by others far removed from railway finishing, for example. This means that provision must be made to keep the interior of the research organization so continually educated and in touch with new discoveries that it will immediately recognize an application of benefit to the special field in question. This is illustrated by a demand upon the part of one of our clients for a recording specific gravity meter for paint that would provide the works manager with a daily chart of the fluctuations in the paint being used. There was no such instrument of this type in use for paint standardization, but it didn't take long to find one in the sugar manufacturing industry which could be used for this very purpose with the result that our client now has the very thing that he wanted.

Aluminum Paint in the Transportation Industry

By H. W. Ostrom
Aluminum Company of America

Aluminum in pure form, stamped out into small flakes, is a comparatively recent addition to the list of pigments used by the painter. This pigment has inherited the name of aluminum bronze powder. Its history dates back scarcely thirty years; one of the first records of its use as an exterior protective coating was

an outside application in Portland, Maine, in 1904.

Aluminum was considered to be a rare metal only forty years ago, and it has developed to its present important commercial position in one generation. The growth of aluminum bronze powder as a paint pigment has also been rapid, although the last ten years have witnessed the greatest strides in this development. Today aluminum paint is accepted as a standard finish for exterior or interior surfaces.

Properties of Aluminum Bronze Powder

Aluminum bronze powder is fundamentally different from most paint pigments because of its method of manufacture. Pure aluminum in sheet form is cut into small squares and placed in stamp mills, where thousands of blows of the stamps hammer the small sheets of aluminum into thinner and thinner flakes. As the stamping operation continues, the metal becomes more brittle and breaks into smaller flakes. The process is continued until the desired particle size is obtained and the contents of the mills are then screened to obtain the desired grades of powder.

The next operation consists of polishing the small particles with a colorless, transparent polishing agent. Extensive research was necessary to perfect the various manufacturing operations, and particularly the polishing process, which gives the small flakes their lustre. This thin film of polishing agent on the flakes gives to them the remarkable property of "leafing."

Leafing

Aluminum bronze powder made in this way, when mixed with a suitable liquid and painted out, gives what is known as a "leafed film." The polished flakes distribute themselves in the paint film much like falling leaves, some of them coming to the top of the film, overlapping, and thereby forming a continuous metallic coating. This leafing is the result of surface tension forces between the polished powder and the liquid surfaces. This apparent floating of the heavier particles of aluminum in the lighter liquid is responsible for many of the interesting and useful properties of aluminum paint.

Aluminum Paint Vehicles

The rapid development of the use of aluminum paint in various industries has been the result of intensive research to develop satisfactory vehicles to meet the various service requirements of industry. Paint and varnish manufacturers have contributed to this development by carrying on a program of research work on the subject of aluminum paint vehicles. Banana oil bronzing liquid has gone forever as an accepted vehicle for aluminum paint. It has been replaced by a series of vehicles adapted for various surfaces to meet severe conditions of exposure and service. You cannot expect a short-oil, high-gum varnish to give the same durability on the outside of a car as could be expected of the same product on the interior. The same general considerations apply, to a greater or lesser degree, when aluminum bronze powder is used as a pigment in varnish vehicles.

There are two general types of aluminum paint vehicles: first, varnish vehicles, and second, oil vehicles. The first type may be further classified into long-oil and short-oil varnish vehicles. Many of the better aluminum varnish vehicles are of the long-oil or spar-varnish type. The presence of chinawood oil in proper proportion improves the durability on exterior surfaces and the moisture resistance on both exterior and interior surfaces. Shorter-oil varnishes are preferred for interior surfaces, because the harder film produced by them minimizes dirt collection.

The long-oil varnishes and mixing oils are required on exterior surfaces because increased elasticity of the paint film is needed to take care of the expansion and contraction of the painted surface and to resist the actinic rays of the sun for a longer period of time. Much work has been done along this line by many paint and varnish manufacturers, resulting in the development of aluminum paints of increased durability and improved appearance.

The oil type of liquid is preferred for priming wood and its use is practically confined to exterior surfaces. Raw linseed oil has been found unsatisfactory because the aluminum paint made with it as a liquid does not set up fast enough, developing sags and runs on vertical surfaces. Boiled linseed oil is occasionally used after having drier and thinner added. Another way to use boiled linseed oil is to mix it part for part with good spar varnish; thin with naphtha or turpentine to the proper consistency, and add two pounds of aluminum powder per gallon. Kettle bodied linseed oil, which has been heated to the proper temperature, driers incorporated, and thinned to proper consistency, is the best type of linseed oil vehicle developed to date for outside wood surfaces. There are other types of mixing oils on the market which also work satisfactorily and have good leafing properties and durability.

A third broad class of vehicles might be mentioned which would include: (1) Heat-resisting liquids to be used in aluminum paints subject to temperatures up to 900°F; (2) lacquers; (3) asphalt varnishes; (4) gloss oils; (5) shellacs, and (6) four-hour or amberol varnishes. These liquids are used to meet unusual conditions and require special consideration, depending on the particular problem.

Preparation and Application of Aluminum Paint

Another outstanding difference between aluminum bronze powder and most other pigments is revealed in the method of preparation of the paint. Grinding is eliminated and aluminum paint is best prepared by mixing small quantities of powder and liquid sufficient for the job to be done, or for one day's painting. There appears to be a solvent or chemical reaction between the thinners and vehicle and the film of polishing compound on the surface of the powder flakes, which partially destroys the leafing property if the paint is allowed to stand for any great length of time. This action is detrimental to the durability and reflectivity of the paint.

The proportion generally recommended is two pounds of powder to each gallon of vehicle, which produces a paint containing about 21 per cent pigment and 79 per cent vehicle. The presence of mica as an adulterant in the powder or excessive volatile thinner in the liquid alters this ratio and either is very undesirable. When painting porous brick or weathered wood, the powder content in the first coat may be reduced to one and one-half pounds per gallon to take care of the increased oil absorption. The liquid is poured over the powder in proper proportion and the mixture stirred with a paddle until smooth.

Aluminum paint may be successfully applied by spraying, brushing or dipping. When sprayed it may be necessary to reduce the air pressure and open the material nozzle farther than is customary with other paints. Aluminum paint works easily under the brush and a helpful suggestion to eliminate brush marks is to brush toward the lap instead of away from it. Each dip job

is an individual problem, depending on the nature and the shape of surface to be coated, drying time, etc.

The fact that aluminum paint is non-poisonous permits its application with safety by any of the methods mentioned above.

The preparation of the surface is an important consideration, no matter what paint is used. The better the surface is prepared the better the paint job. Sufficient drying time should always be allowed between coats.

Properties of Aluminum Paint

Opacity—The aluminum flakes are opaque to light and a well-leafed one-coat aluminum paint film has an opacity greater than five coats of ordinary white paint. This consideration, together with the fact that there is a maximum of pigment at the surface of the aluminum paint film, increases the durability, because the damaging rays of the sun are prevented from attacking the liquid underneath the overlapped metal flakes. This remarkable opacity gives unequalled hiding power. Usually one coat will cover over black or other dark colors.

Reflectivity—The extensive adoption of aluminum paint by the petroleum industry was due, in part, to its high reflectivity. One coat usually develops sixty to seventy per cent reflectivity, while two or three coats of ordinary white paint are necessary to surpass this figure, over a dark surface.

The Bureau of Mines has conducted extensive tests to determine the effect of tank colors on evaporation losses of crude oil, using 55,000-barrel storage tanks in the tests. The results published in their report, Serial No. 2677, are given in Table I.

This property of reflecting light is also used to advantage on interior surfaces, reducing the necessity for artificial lighting to a minimum.

Table I—Evaporation Losses from Oil Tanks in Bureau of Mines' Test

Color of Tank	Initial gage, barrels	Evaporation loss in one year, barrels	Loss in gravity in one year, deg., A.P.I.
Black	52,058	649	.6
Red	52,294	609	.5
Gray	53,192	547	.3
Aluminum	53,418	447	.2

Moisture-Proofing Power—The useful fact that aluminum paint has a very high waterproofing power was discovered in the Forest Products Laboratory of the Department of Agriculture at Madison, Wisconsin. Table II shows in brief the results of their investigations.

These results have led to the establishment of the fact that aluminum paint is an excellent priming coat for wood. The protection to the wood remains during the entire life of the paint film and weathering is reduced to a minimum. The Forest Products Laboratory has recently stated that new wood is not as porous as has been considered by Master Painters; porosity comes with weathering. New wood should therefore be primed with a paint having good body and sufficient pigment to water proof the surface. The day may not be far distant when aluminum paint will occupy the same position as a wood primer as red lead, for example, has as a metal primer.

Resistance to Sulphur and Other Compounds

Railroads always have the problem of combating the sulphur fumes found in the smoke shooting from the stacks of locomotives. Aluminum is comparatively inert to these fumes, and aluminum paint does not discolor and shows good service under these conditions.

You are frequently called upon to finish over oil-soluble stains, such as mahogany-stained woodwork on car interiors. The practice of sealing the surface with aluminum paint has been followed by master painters for a number of years. It is also possible to paint creosoted lumber and surfaces painted with bituminous products, provided sufficient time has been allowed for weathering or drying and a hard drying varnish vehicle is used for the aluminum paint.

Decorative Value

The modern tendency in decoration has led to the use of glazed finishes which are seen on car interiors. The surfaces are coated with aluminum paint and semi-transparent colored lacquers are sprayed on, permitting the silvery base coat to shine through.

Uses

Now let us take a few minutes to suggest uses for aluminum paint which take advantage of the properties just outlined.

The property of giving good protection to metal and reflecting the sun's rays has established aluminum paint as a standard for tank cars and oil storage tanks.

Several railroads and owners of refrigerator cars have taken advantage of the value of aluminum paint as a protective coating on wood and its ability to reflect the sun's rays by adopting it as an exterior finish on refrigerator cars. Aluminum paint is also used on the interior of refrigerator cars because of its hiding power in one coat and its ability to reflect light.

The protective value on steel and wood and the resistance to sulphur makes aluminum paint a desirable finish for hopper cars. Several roads now have test cars in service.

The modernistic glazed finish is being applied to advantage in dining-cars and club-cars.

A number of passenger- and sleeping-car roofs have been finished in aluminum, thereby taking advantage of the reflectivity and durability. The test applications are now in service in the warmer climates of the southwest and the Pacific coast. Aluminum paint will adhere to galvanized metal and is therefore good coating for car roofs.

Table II—Moisture-Resistance of Various Coatings According to Forest Products Laboratory

Coatings	Number of coats	Moisture-proofing efficiency, per cent
Pitch paint plus aluminum powder		98
Asphalt paint	3	96
Spar varnish plus aluminum powder		94
Bronzing liquid plus aluminum powder		93
Graphite paint	3	61
Spar varnish	3	60
White lead in oil	3	54
Linseed oil		17
Bronzing liquid		11
No coating	0	00

The moisture-proofing property could be used to advantage in priming wooden freight cars and stock cars. The ability to seal oil stains makes aluminum paint a desirable finish for freight car floors and other interior surfaces of cars used for carrying flour, grain, etc.

Many of you may be asked to refinish busses and airplanes before long, and aluminum paint is established as a desirable finish for this equipment.

Although this section is mainly concerned with equipment painting, I assume that you are frequently asked to recommend paints for railroad buildings and other company equipment. I am, therefore, taking the liberty of suggesting other possible applications that may be of

value and interest to you. Many roads use aluminum paint on shop and storehouse interiors because of its high one-coat hiding power and good light reflection. Aluminum paint has been adopted by a number of roads for painting signal towers, water tanks, bridges, and other right-of-way structures, because of its high visibility, durability, and resistance to fumes. Priming new stations and painting roofs of buildings in warmer climates would be desirable.

Report on Shop Construction and Equipment

Since our last annual meeting, the Committee on Shop Construction and its Equipment has been the recipient of several communications from members of this association asking if we had developed anything new on the subject of ventilation which will protect the operator from the spray dust and, at the same time, act as a protection against fire or a possible explosion, while spraying passenger cars.

The subject of spraying and the proper ventilation to take care of the fumes, etc., caused by the spraying of the various materials now in use, is very important and with this thought in mind your committee has investigated several different systems of ventilation.

The process of spraying passenger cars and other equipment has aroused the interest of insurance engineers and railway managements towards surrounding the practice with such safeguards and efficient equipment as will afford the proper protection against fire and health hazards.

With the advent of modern, quick-drying finishes there has also come potential hazards due to the volatility of such finishes. It is also the belief of some persons that a health hazard has been introduced, but this depends entirely upon two factors: toxicity of the material used and the efficiency of the exhaust equipment. The latter, if suitable to control fire hazards, will adequately control any possible health hazard.

We are favorably impressed with the fact that suitable exhaust equipment has been developed especially adapted to finishing railway and other transportation equipment which, if properly installed, is calculated entirely to control any hazards of this nature.

Serious consequences for our employers may arise from the failure to adopt modern and efficient exhaust equipment when it is generally recognized that such unguarded hazards exist. As foreman in charge of painting, we should appreciate this fact and be on the alert to recommend to our superiors that a properly designed equipment be installed, which will afford full protection against both fire and health hazards, however they may arise.

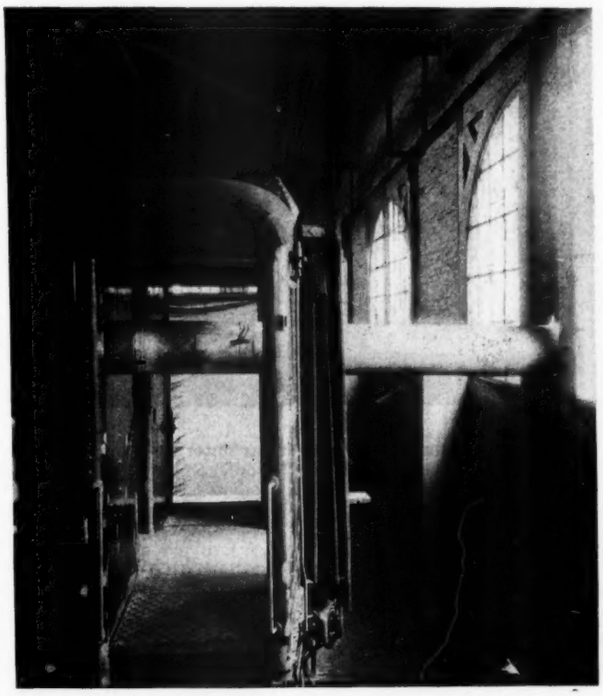
Modern Ventilating Equipment—The Portable Canopy Exhaust

While in Toledo, Ohio, in May of this year, your committee had the pleasure of visiting a plant wherein different types of exhaust systems are built. We were very favorably impressed with one of these, and we will tell you as briefly as possible how the system was explained to us.

The first is known as the stationary type of spray finishing exhaust system. This system possesses the novel feature of combining the forced draft with the suction type system which is especially fitting for the spraying of passenger car equipment. Highly efficient suction exhaust is provided for in the super structure by the use of either the indirect induced draft method or by the use of the direct principle employing a non-sparking metal fan. This portion of the system is safely isolated above the roof. Illumination is provided for by vapor-proof lights which are located safely outside of the booth. Approved sprinklers are incorporated throughout the superstructure. The electrical installation is strictly in accordance with the National Electrical Code.

The superstructure is so designed that it can be readily adjusted to car roof painting as well as to the painting of the car body and underframe. An advantage of the system as explained to us, lies in the combination of the pressure air supply with the suction exhaust described above. The pressure air supply is provided for by air trenches or slots which are located along side of each track through which a current of air moves upward between the operator and the surface he is working upon.

This protects the operator from any rebound of mist



Exhaust system for passenger-car interiors, showing duct to outer air

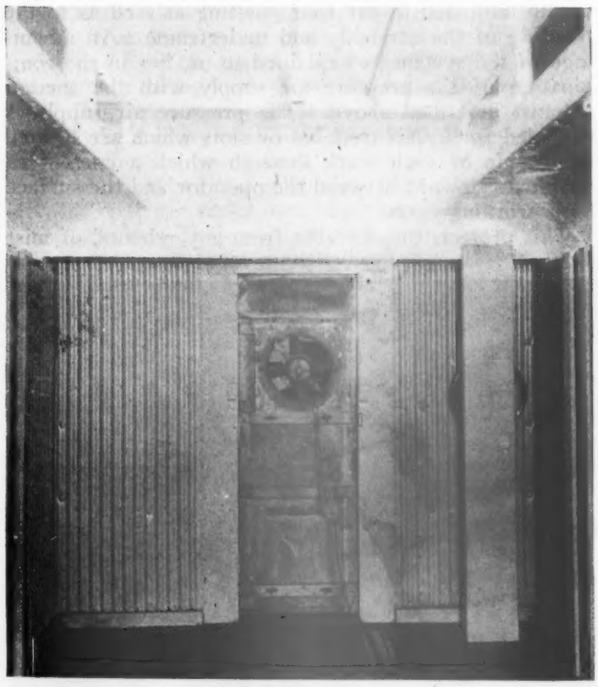
which might be created and the inhalation of any deleterious vapors or substances. This current or sheet of air in conjunction with the overhead suction device is of sufficient velocity to carry the vapors and residues directly through the stack into the open air. The air slots or trenches are supplied with air through a set of ducts, one for each track which comes from a pressure type blower located away from the point of spraying. A duct is provided whereby fresh air is brought to the blower from outside of the building which may, if desired, be pre-heated in order to maintain the proper temperature in the building.

The trench that supplies the air to the slots is covered by trench plates and these insure an equal distribution of air throughout its length paralleling the track on

which the car rests. The top of this air trench arrangement is flush with the floor.

A portable type has also been developed; this can easily be moved about the shop and adjusted over any piece of equipment which may require painting. This avoids shifting or spotting of cars to a certain location and is quickly shifted to the car which is to be painted. This portable outfit is simply the stationary type with wheels and drive motor added and automatic control and stopping switch. Staging is also provided.

The canopy, staging, input air blowers, together with



Exhaust system for passenger-car interior—The fan is inserted in the door frame

air ducts, and the exhaust fans are supported by and travel on tramway rails which are hung to roof trusses or other building construction, which may be reinforced if necessary to carry the load. The exhaust pipes above the point of contact with movable sections are stationary. The contact between the movable and stationary sections is made by sliding shoes which are made of non-sparking metal. Automatic starting and stopping controls insure correct centering of the movable with stationary connections of exhaust pipes at each stopping point. The movement of this portable type exhaust is lengthwise of the track over which it is installed and this movement is similar to that of a traveling crane. Its operation as an exhaust is exactly the same in every detail as the stationary canopy type.

We see one objection to offer in using the canopy type of booth, which is mounted overhead of the car, and that is that it may shut out a great deal of light that is necessary for the painting of cars. Most shops are equipped with skylights and where a canopy is mounted over the car it would throw a large shadow underneath. This of course would mean that artificial light would have to be employed.

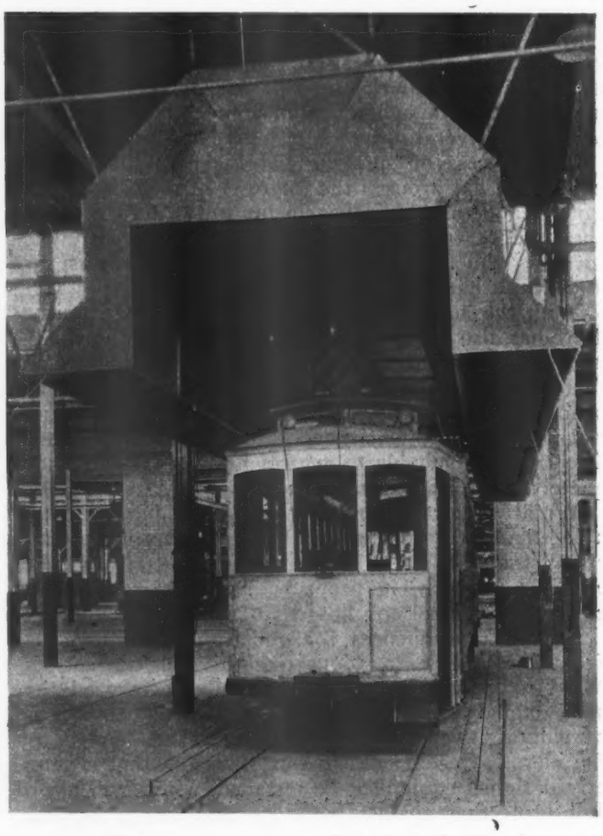
Car Interior Exhauster

We are indebted to K. J. Johnson for the accompanying photographs showing the exhaust system used by the Nashville, Chattanooga & St. Louis for spraying the interior of cars. As we understand this system, in the doorway at one end of the car you can see fastened into a permanent frame a fan which, when turned on, drives all the fumes made by the operator in spraying to the other end of the car. Here is fastened a large ventilator pipe in like manner as the fan, except that the pipe extends out from the doorway and through the end of the shop and through this pipe is carried all the vapors and fumes from the car into the open air outside the shop.

We are still of the opinion, for reasons set forth in our report of last year, that the spraying of cars should be done in a separate building set aside for that purpose, regardless of what exhaust system may be employed.

The Proper Housing of Freight Cars While Being Painted

A considerable amount of thought has been given and discussions have been held pro and con on the care of



Stationary canopy-type exhaust system

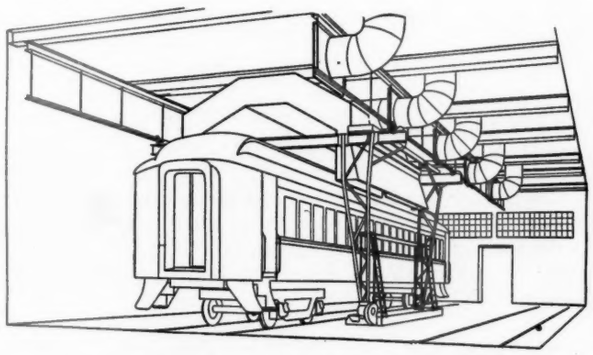
passenger car equipment. Concerning this we have no just criticism to make, but due to the fact that the railroads are spending thousands of dollars each year on the painting of their freight equipment your committee feels that some consideration should be given at this time, to advance if possible some tangible idea for the betterment of present conditions under which most of the freight-car painting is being done.

The most outstanding thought in this direction would be to suggest that the painting of freight car equipment (particularly box cars), should be done under cover, and not outside in the open air, where they are sub-

jected to all of the elements. This practice not only retards production but in a more vital sense causes the material which is applied to deteriorate more rapidly than if applied under more favorable conditions. The continuance of the open-air practice of painting therefore means that these cars, if they are to be kept fit, will in most cases be brought back for repainting much sooner than otherwise. This, of course, means additional cost in labor and material plus the lost time the car is out of service.

In view of these facts concerning the painting of box cars, we recommend that a special shop be provided, of suitable size and of such material as will guarantee full protection from the elements and that this shop be heated sufficiently to assure the proper drying of the materials applied.

We should like to say that, in addition to having



Portable canopy-type car exhaust

these cars painted under cover, if the railroads would be especially particular about the quality of paint that is used on their cars, we feel reasonably sure that the results would be more satisfactory and a substantial saving in real money would be shown at the end of a year's time.

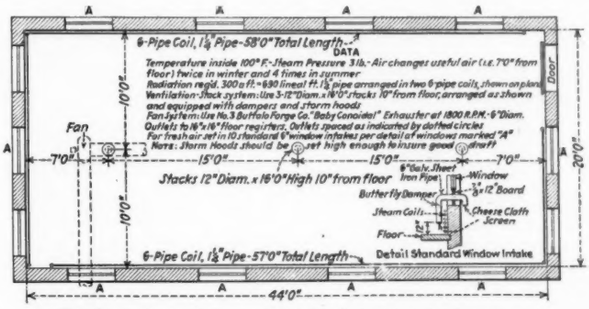
Humidity and Drying Conditions

The increasing demand for production, plus the amount of inexperienced help of the present day, makes it more essential than ever before to adopt and to use every improved method possible to hold up the quality of the work, and at the same time to get it out on time. This problem in a great measure finds its way to the varnish room, where sash, doors, berths, seats, etc., are being forced through in order to be finished in time for the trimmers.

It was for the purpose of assisting this condition that we made a search and have found something which we recommend to aid the drying of the paint and varnish over night regardless of the atmospheric conditions which many times retard the progress of our work.

If we heat the finishing room at night to 100 to 110 deg. F. and at the same time provide for constant circulation of fresh air as well as for constant removal of the foul air, we change a very bad drying condition to one that will give the best possible results.

The entire finishing room should be conditioned first by placing the proper amount of steam radiation or hot-air ducts along the side walks near the floor to raise the temperature of the room to 100 deg. F. any night in the year and secondly by admitting sufficient fresh air into the room near the floor in such a manner that it will pass over the radiators, be raised to room temperature, pass over and around the work and finally be drawn down and off at some point near the floor and as far from the radiators as possible, thus giving a constant even circulation of fresh air. The radiators

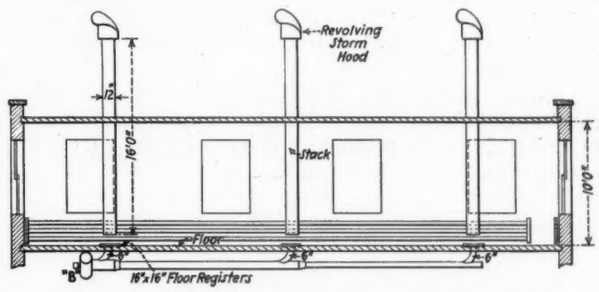

A
6-Pipe Coil, 1¼" Pipe-58'0" Total Length
DATA
Temperature inside 100° F.-Steam Pressure 3 lb.-Air changes useful air (i.e. 70° from floor) twice in winter and 4 times in summer
Radiation reqd. 300 a ft.=690 lineal ft. 1¼" pipe arranged in two 6-pipe coils, shown on plan
Ventilation-Stack system: Use 3-12" Diam. x 16'0" stacks 10" from floor, arranged as shown and equipped with dampers and storm hoods
Fan system: Use No. 3 Buffalo Forge Co. "Baby Ganoided" Exhauster at 1800 R.P.M.-6" Diam.
Outlets to 16"x16" floor registers. Outlets spaced as indicated by dotted circles
For fresh air set in 10 standard 9" window intakes per detail of windows marked "A"
Note: Storm Hoods should be set high enough to insure good draft
Fan
10'0"
7'0"
15'0"
15'0"
7'0"
Door
20'2"
Stacks 12" Diam. x 16'0" High 10" from floor
6" Galv. Sheet Iron Pipe
Window
⅜" x 12" Board
Butterfly Damper
Steam Coils
Cheese Cloth Screen
Floor
10'0"
6-Pipe Coil, 1¼" Pipe-57'0" Total Length
Detail Standard Window Intake
44'0"

Typical layout for conditioning the drying room

should never be placed on the ceiling nor in the center of the room as this not only increases the expense of heating but also interferes with good circulation. The heat should be turned off at three or four o'clock in the morning by the watchman and the ventilating system left on. This will cool down the room and allow the paint and varnish to harden properly before the workmen return to work.

The plans submitted with this report show details of a typical layout that is economical to install and provides a means of easily securing the desired results.

The fan method is preferable since it gives a definite, positive circulation of air at all times, which is independent of the velocity or direction of the wind



Sectional elevation of a typical layout for conditioning the drying room

This shows both fan and stack construction, only one of which is required. Fan construction is preferable, as it is independent of weather conditions.

as well as other weather conditions. The stack method, however, has been found to give excellent results, where it is not thought advisable to install the more expensive fan system. It should be noted that only one of these methods need be used in the same room.

The great benefit to be gained by the proper use of any varnish drying system that provides automatic control of the three vital factors, is not so much in the hastening of the finishing schedule to dangerous extremes, as in the control of the elements so that every day will be alike and favorable to varnish drying. This insures the maintenance of definite schedules and makes it possible to get constant results. It should be understood, however, that a suitable varnish drying equipment, properly operated, will turn out work in shorter time than under ordinary air drying conditions that are constantly changing.

We are thoroughly convinced that the conditioning of the entire finishing room is worth while and that excellent results could be obtained by having it installed.

The report was signed by F. Clement (chairman), master painter, American Car & Foundry Co.; A. C.

Boyle (N. Y., N. H. & H.); C. E. Ream (Penna.); W. F. James (A. C. L.); D. G. Richmond (Pullman Co.); W. M. Joyce (Baldwin Locomotive Works); and S. H. Rauenzahn (Reading).

Discussion

The tenor of the discussion on the subject of Shop Construction and Equipment was to the effect that the materials and equipment for finishing cars and locomotives have undergone remarkable development within the past few years and that these new developments have introduced shop problems which have not been given as serious consideration as their importance warrants. Several members emphasized the great importance of adequate ventilating systems for passenger-car shops where the materials are applied by the spray process, and endorsed heartily the recommendations of this year's committee. J. W. Gibbons of the Santa Fe described in some detail the "gravity" type of paint-spray equipment which it is said reduces, to a great extent, the volume of spray vapor which floats into the air as a result of the spraying operation. This system differs from the conventional type in that the finishing material flows to spray gun by gravity only and it is projected onto the surface being finished by an air pressure of from 20 to 40 lb. per sq. in. Mr. Gibbons also made a plea for more elaborate service testing of finishing materials by the railroads and remarked that many railroads seem to use their chemists not to make good paint, but to enable them to get by with poor paint. "Every paint shop," he said, "should be a laboratory for testing the service possibilities of paint." Marceau Thierry of the Norfolk & Western remarked that every modern paint shop should be equipped with a ventilating system equal at least in efficiency to the modern spray gun. Mr. Thierry also drew attention to the real importance of installing drying facilities in paint shops to promote efficient circulation of the air at the correct temperature so that it does not become saturated with volatile matter and retard the quick and complete drying of the finished surfaces.

Equipment Painting Practices

After careful consideration your committee feels that it is entirely impractical to establish definite painting practices, and it will be noted in the following recommendations that they are only general as some of our railroads have their passenger equipment finished entirely differently from others. For that reason the following different methods of painting equipment are presented for consideration. Your committee considers them good practice.

Exterior of Steel Cars for Paint and Varnish Finish

First day—Sandblast and prime,
Second day—Stand to dry,
Third day—Coat of surfacer,
Fourth day—Putty and knife in uneven surface,
Fifth day—Sandpaper and second coat of surfacer,
Sixth day—Sandpaper wet or dry; if sandpapered with water, this day should be allowed for drying,
Seventh day—Apply body color,
Eighth day—Letter and coat of varnish,
Ninth day—Stand to dry,
Tenth day—Second coat of varnish.

The above requirements are considered as minimum requirements and additional coats of surfacers and varnish may be applied, and by the use of quicker drying materials, the schedules can be shortened at the option of the railroad. The primer, surfacers, body color and varnish can be applied very efficiently by the spray method. Owing to the fact that wooden equipment is fast going out of service, we do not make any recommendations for the exterior of such equipment.

Interior of Cars with Steel Finish Painted and Varnished

First day—Sandblast and prime,
Second day—Stand to dry,
Third day—Coat of surfacer,
Fourth day—Putty and knife in where necessary,
Fifth day—Sandpaper and coat of color,
Sixth day—Coat of enamel,
Seventh day—Stripe and ornament or a second coat of enamel.

If graining is preferred, then on the

Fifth day—Sandpaper and apply first coat of ground color,
Sixth day—Second coat of ground color,
Seventh day—Grain,
Eighth day—First coat of rubbing varnish,
Ninth day—Stand to dry,
Tenth day—Second coat of rubbing varnish,
Eleventh day—Stand to dry,
Twelfth day—Rub if desired.

The primer, surfacers, color or ground coats, enamels or varnish can be applied very efficiently by the spray method using an exhaust fan installed in end of car in order to carry off all fumes and mist which results from spraying.

Interior of Cars with Wooden Finish to Finish Natural

First day—Filler coat,
Second day—Putty,
Third day—First coat of rubbing varnish,
Fourth day—Stand to dry,
Fifth day—Second coat of rubbing varnish,
Sixth day—Stand to dry,
Seventh day—Third coat of rubbing varnish,
Eighth day—Stand to dry,
Ninth day—Rub, if desired.

These varnish coats can also be applied very efficiently by the spray method in same manner as mentioned above where shop conditions, ventilation, climatic conditions, etc., will permit. The seat frames, steam pipes and guards, and floor, can be coated on days while varnish is drying.

Headlinings—Enamel Finish

First day—Prime,
Second day—Stand to dry,
Third day—Coat of surfacer,
Fourth day—Putty and knife in where necessary,
Fifth day—Sandpaper and coat of enamel,
Sixth day—Stand to dry,
Seventh day—Second coat of enamel,
Eighth day—Stripe and ornament.

Striping and ornamentation may be varnished over, if desired, which will add a day to this schedule.

Headlinings—Varnish Finish

First day—Prime,
Second day—Stand to dry,
Third day—Coat of surfacer or color,
Fourth day—Putty and knife where necessary,
Fifth day—Sandpaper and coat of semi-gloss color,
Sixth day—Stand to dry,
Seventh day—Second coat of semi-gloss color,
Eighth day—Stripe and ornament,
Ninth day—Coat of varnish.

The primer, surfacer, color, enamel, semi-gloss color and varnish can be applied very efficiently by the spray method using an exhaust fan installed in end of car as mentioned above where shop conditions will permit. These two headlining schedules are included to cover enamel and semi-gloss with varnish systems. The headlinings can be coated while the inside body is standing to dry. The baggage racks or baskets, seat irons and screw heads, if they are painted, can also be sprayed outside of the car in the shop.

Exteriors of Steel Cars for Lacquer Finish

First day—Sandblast and prime (48 hr. primer),
Second day—Stand to dry,
Third day—Coat of surfacer (24 hr.),
Fourth day—Putty and glaze where necessary,
Fifth day—Sandpaper and second coat of surfacer (24 hr.),
Sixth day—Sandpaper and apply one coat of pyroxylin type-surfacer allowing two hours drying time, scuff off lightly with very fine sandpaper, apply first coat of lacquer, allowing two hours between coats and then apply second coat of lacquer,
Seventh day—Apply third coat of lacquer, lay off and letter two coats of brushing lacquer of imitation gold color. If gold leaf is desired, apply the proper sizing with pencil brush and lay the leaf,
Eighth day—If gold leaf is used, pencil over gold with two coats of proper clear outside lacquer allowing two hours drying time between coats. If finishing varnish is used over gold leaf, apply one coat and stand to dry on the ninth day and apply second coat of varnish on the tenth day; apply all above coats with spray except lettering.

Interior of Cars for Lacquer Finish

First day—Sandblast and prime (48 hr. primer),
Second day—Stand to dry,
Third day—Coat of surfacer (24 hr.),
Fourth day—Putty and glaze where necessary,
Fifth day—Sandpaper with fine paper, and apply one coat of pyroxylin type surfacer of a color suitable for lacquer coats,
Sixth day—Sandpaper lightly with very fine paper and apply two or three coats of lacquer. Where two or three or four tone color scheme is desired, same can be done in same day by using a shield to protect one color from the other, and this may take an additional day's time,
Seventh day—If striping or ornamentation is desired, apply colors with brushing lacquer, or if transfers are used, these can be protected by brushing clear lacquer over them with pencil, or the entire surface can be sprayed with one or two coats of the proper clear lacquer.

If metal headlinings are used in cars with interior wood finish they can be also finished with lacquers. All of the above coats with the exception of the striping or any ornamentations can also be applied very efficiently by the spray method as mentioned above.

Roofs and Decks

Sandblast and prime with basic chromate of lead primer followed with not less than two coats of railroad company's standard roof paint. If roof is newly applied, all lap joints should be protected with an inhibitive primer and sealed with a heavy car roof cement.

Underframe

Sandblast and prime with red lead or any other inhibitive primer and one or two coats standard underframe black or a heavy cement. Each of these coats should be sprayed.

Battery Boxes. Steps and Trap Doors

Sandblasted and primed same as body of car, then apply not less than two coats of standard color.

Trucks

Outside, primed and two coats of standard color. Inside, one or two coats of railroad company's standard underframe black. Each of these coats may be applied with a spray.

Freight Car Equipment and Its Protection

In general and with particular reference to new steel box cars. In view of the fact that in the manufacture of new steel freight equipment, railroads are more or less using copper-bearing steel and that this material is more or less free from mill scale, etc., we are not recommending sandblasting for open top cars.

New Steel Box Cars

Riveted joints and all parts of steel which come together should have one coat of a good metal protector paint before assembling after same is thoroughly cleaned.

Entire Inside, Except Floor

Should receive one coat of an inhibitive primer or a metal protector primer and followed by one coat of railroad company's standard paint, preferably oxide of iron.

Entire Outside Body and Steel Roof

Should receive one coat of red lead or an oxide primer after steel is thoroughly cleaned, and this followed by two or three coats of railroad company's standard freight car paint.

Open-Top Cars

The same method outlined above will apply with the exception of the inside which may be given only one coat of a metal protector paint, either red lead, or an oxide of iron, or the standard color used on outside.

Underframe

Should be thoroughly cleaned and then given a metal protector paint and then followed by one coat of railroad company's standard underframe paint.

Trucks

Should be thoroughly cleaned and then given a metal protector paint and then followed by one coat of railroad company's standard color.

Your Committee recommends that all paint on freight equipment be sprayed on.

The report was signed by K. J. Johnson (N. C. & St. L.); D. C. Sherwood (N. Y. C.); H. B. Weisgarber (Southern); E. M. O'Brien (I. C.) R. B. Batchelor (Wabash); W. F. James (A. C. L.); T. M. Davis (Sou. Pac.) and P. Bernet (American Car & Foundry Co.).

Discussion

In discussing the Report on Equipment Painting Practices several members took exception to the wording of the paragraph referring to "Freight Car Equipment and Its Protection" in that the original wording seemed to infer that the committee did not recommend the sandblasting of open top freight cars. After some discussion the recommendation was made to change the wording of the paragraph in question to read: "The sandblasting of open top cars may not be necessary but may be advisable." Many of the members seemed to feel that sandblasting is vitally important on all cars in order to provide an adequately prepared surface for the application of the protective coating

and the objection raised to sandblasted surfaces was that it was more susceptible to corrosion if not immediately painted. One member said that his road considered sandblasting so desirable that it ordered steel sheets for new car work delivered to them sandblasted and primed with a coat of red lead. The question of underframe protection was raised and most of the members seemed to be agreed on the point that the best method of protecting the inaccessible parts of a car underframe was by sandblasting and spraying.

Report on New Developments in Equipment Painting

Test of Synthetic Varnishes

We have had a number of tests made of synthetic varnishes that dry in from three hours up, with which two coats of varnish can be applied the same day and the car be out of service the following day. Your committee respectfully reports that the application of this type of varnish by brush is very difficult. Brush marks show up distinctly; when applied with spray, goose flesh or pebbling is very general. None of the tests of this material have been in service long enough to indicate results.

Bakelite

We have made some tests of this material which is received as a primer, glazing, and surfacing system, and finishing coats of any color desired. The surfacing system is rubbed down to a smooth surface very easily. The finishing coats of Pullman color enamel, which we applied, dry quickly, two or more coats being applied in one day when necessary. We lettered a car and applied two coats of clear Bakelite over the Pullman color. A panel of this material will be submitted for inspection. There is nothing in this material that is injurious to health but the odor is very objectionable to most men.

Rubbing Device

With the use of the spray gun in applying all classes of finishing material, painting of railway equipment has become a simple task. Great economy has been effected particularly in the finishing of passenger-train cars. One feature in securing a desirable surface that has cost a great deal of money is rubbing the surfacer system down to a smooth finish, which up to within the last two years has always been done by hand, either with wet and dry sand paper or rubbing rock. Your Committee now desires to report that the rotary rubbing device that is now on the market has made considerable progress toward overcoming the difficulty in performing the undesirable part of securing a first class surface on the exterior of our passenger equipment, namely, that of sand papering or rubbing down to surface.

Like all new devices there is a difference of opinion as to the utility and practicability of this rubbing device, but your committee believes that, with experienced men that can be developed within a reasonable length of time, this device will be along the line of progress in painting passenger car equipment.

Lacquer vs. Varnish System

At the previous conventions of this organization your committee has reported progress of the lacquer system of finishing car equipment. We wish to report now that lacquer is one of the most desirable finishes that can be applied to passenger equipment, both interior and exterior. Your committee desires to emphasize the fact that all lacquers are not recommended; in our judgment there is just as much difference between the various grades of lacquer that are now on the market as there has been in the different grades of varnish manufactured and sold on the market. We have tested a number of lacquers that have been a complete failure and we have tested some varnishes that have given us universal satisfaction and good service on the exterior of passenger cars for 36 months and still retained a good gloss free from checks, cracks or any apparent deterioration. However, your committee wants to go on record as saying that the finishing of the exterior of passenger cars with lacquer has several desirable qualities that will effect economy and save time of the car in the shop. Your committee desires to point out, however, that in the finishing of the exterior of a 70-ft. car with lacquer the first cost will be greater than for a car finished with varnish, but the lacquer properly made and applied will have the following advantages:

First—It will give a train of cars a uniform appearance.

Second—The surface can be easily cleaned and maintained in service over a longer period of time as a rule than the varnished car, which in our judgment will overcome the extra cost of applying the lacquer.

Third—The refinishing of a car that has been properly maintained can be done in less time with lacquer than it can be with the varnish system, and, every day saved in the shopping period of a car finished in lacquer over that finished in varnish will be an economy equal to the value of the car to the company per day.

We believe it is universally agreed that lacquer in light colors such as Tuscan red, light blue, and fugitive colors of that nature are not a success in finishing the exterior of a car.

There have been some claims made against lacquer by those who favor the varnish system that the lacquer is more easily broken on rivet heads and projections of a car than the varnish system. We have a large number of cars finished in lacquer that we have personally inspected and we find that unless the cars are cleaned with the scrubbing device or machine such as the rotary brushes we have had no trouble maintaining the lacquer in a uniform solid appearance.

Interior

We believe that it is universally agreed that on the interior of passenger carrying cars, especially where light colors are used, lacquer gives a smoother and better appearance and wears longer than the varnish system and is not as easily affected by the attrition of washing and scrubbing necessary to maintain the car in a sanitary and clean appearance.

The committee in conclusion desires to point out that the success of any system depends on the character and ability of the manufacturer to produce a desirable quality of material and maintain a standard that will be uniform in both appearance and durability. There has been more loss and deterioration of equipment due to the purchase of inferior paints than from any other cause in the operation of railroads. We feel it our duty to point out to the mechanical, operating, and purchasing officers of the railroads that a test made by analysis only is of no practical value in determining the durability of the material and in testing varnishes and lacquers. While your committee realizes that there are

accelerated tests that are of great value, the only real test that can be depended upon to determine the quality of these or any other painting materials is the service test.

Floor Sealer Coat

We have reports from a number of railroads located in different parts of the country where the sealer coat which we advocated a test of about three years ago has been adopted as standard practice, a number of others are still running tests of these materials. There have been at least three manufacturers that have taken up this subject and are putting on the market a material known as car floor sealer.

The outstanding report favorable to this material is that a refrigerator car loaded with eggs was wrecked and before it could be handled the eggs were badly decayed, a great many of them broken, saturating the lumber on the interior of the car. When the car was shopped and the necessary repairs made, it was found that disinfecting the car was of no avail in removing the odor. The management considered the only possible action would be to scrap the body of the car, but as a last resort it was agreed that they apply a sealer coat all over the interior of the car and then finish it up with a light silver gray enamel. This was done and there was no odor apparent in the car. The last report was that the car had been in service for four months without complaint from any source.

On the same railroad an automobile car had been loaded with raw hides and the same trouble experienced. The same treatment was given. This car has been in service for three months and at the last report there was no complaint made.

We have also received some reports that, where flour and cement is loaded in cars that have been treated with this sealer coat, the heat has brought the oil out through the sealer coat. However, there is a doubt in the minds of the committee as to whether the floors were properly cleaned before the sealer coat was applied. We realize that, if there is a thick scum of grease or dirt on the car floor and if it is painted before it is properly cleaned, the paint will not harden sufficiently at that point to resist the action of the heat and it will not blister. Other reports from flour shipping points say they have had no complaints from this source.

Summing up the information obtained, your committee believes that the sealer coat is a very valuable material for the purposes outlined and will be the means of saving a great deal of money as well as keeping the cars in service more regularly.

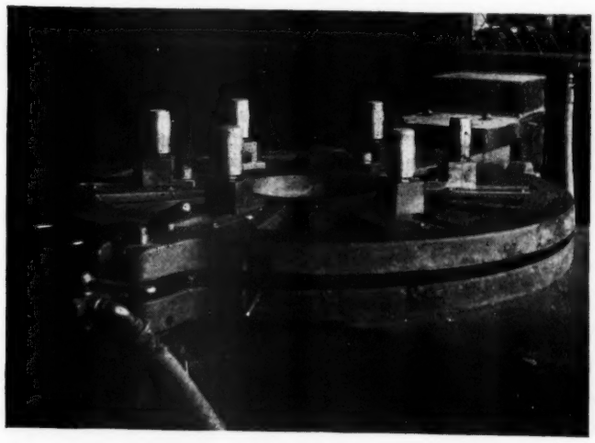
The report was signed by J. W. Gibbons, chairman (A. T. & S. F.); B. E. Miller (D. L. & W.); K. J. Johnson (N. C. & St. L.); B. F. Fultz (N. Y. C., Ohio Central Lines); G. S. Corson (N. Y. C.); Marceau Thierry (N. & W.) and W. F. Schwenk (Mo. Pac.).

OIL-ELECTRIC RAIL CAR.—"The Oil-Electric Rail Car" is the title of folder D.M.F. 5183 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This folder announces a new Diesel engine weighing only 23 lb. per horsepower. The engine has been proven thoroughly in service and the fuel cost has been determined to be 75 per cent less than for the gas engine, even though maintenance costs are approximately the same. The carbon monoxide content of the products of combustion is much less in the oil engine.

Packing-Ring Cutting Device

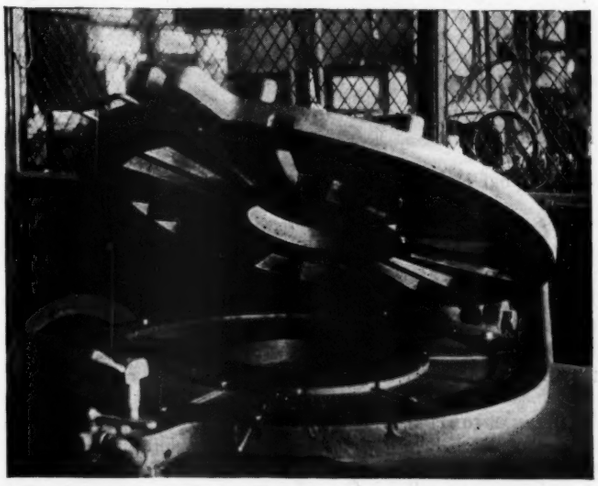
AN efficient device used at the Transcona shops of the Canadian National at Winnipeg, Man., for cutting section piston packing rings consists of two cast-iron plates hinged as shown in the illustration, the top plate being counterbalanced. Knives which are inserted in the bottom block are spaced to cut the piston ring into six sections. These knives extend the full width of the groove—5-in.

Depending upon the diameter of the piston ring to



Packing-ring cutting device ready for application of air clamp which closes it tight

be cut, this groove is filled in with spacing rings, leaving only the correct space for the piston ring; this insures its being located centrally in the machine. The piston ring, which is grooved on one side, is placed flat side down on top of the knives. The top plate is then lowered and held in place with a small air clamp, which is fastened to the bottom plate. The top knives are shaped to fit the groove in the piston ring and each is fastened on a spindle which has a working fit in a holder mounted in the top plate. A spring placed un-



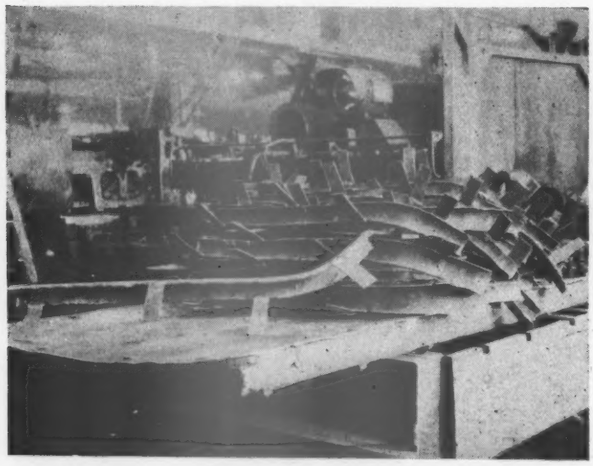
Sectional Piston Packing Ring Cutting Device Used at Transcona Shops of the Canadian National—Open Position

derneath the head of the spindle fits into a recess in the holder. The six holders are located in radial slides directly above the knives on the bottom casting and a graduated scale on each slide locates the top knives according to the diameter (from 21½-in. to 29½-in.) of the piston rings to be cut. As the knives in the top spindles are shaped to suit the groove in the piston ring, it is an easy matter to place them in position and then tighten the bolt on each holder. The machine is now set to cut any number of rings of that diameter and all that is now required is to give the top of each spindle a smart blow with a light sledge hammer, release the air clamp, and pick out the piston ring in sections, having a nice clean cut that only requires a touch on a fine emery wheel or file to remove any small rags on the end face.

Apart from the saving of time in this operation, the main feature of this device is that the piston rings can be machined to the correct diameter of the cylinder, whereas if they were cut with a saw it would be necessary, owing to the amount of material removed by each cut, to machine the piston rings to an oversize dimension in order to maintain the clearance called for in the maintenance regulations.

Superheater Flue Shims

CONDEMNED boiler tubes are not scrapped at the Denver shops of the Denver & Rio Grande Western, but instead are split in half with the acetylene torch, cut into sections varying from 10 in. to 3 ft. in length



An original idea for protecting superheater flues from heat and cinders

and bent at the blacksmith shop to fit the curve in a set of superheated tubes. Four strips of metal 3 in. long and 1 in. wide are welded to the edge of each piece of flue to hold it on the superheater tube. These shims have been found to prolong the life of the tubes by protecting them from the action of cinders.

INTERNAL-COMBUSTION ENGINE DRIVE.—The Geo. D. Whitcomb Company, Rochelle, Ill., has prepared a booklet entitled "Locomotives with Internal Combustion Engine Drive," in which it endeavors to tell of the advantages, uses, economies and savings effected by using locomotives powered with internal combustion engines over other types of power are discussed.

How Not to Ream A Driving Box

THE two illustrations reproduced from the Gulf, Mobile & Northern Employees' Magazine show the wrong way and the right way of reaming a driving box. The one illustration shows the machinist in the

When reaming a driving box, never set it on its edge

wrong position, in which his helper is of no assistance at all. If the reamer should stick in the hole and tilt the driving box, it would fall on the machinist's foot. If the helper had taken the proper position holding the

Proper position of the driving box and the workmen

motor, he could prevent an accident, even in case the box should fall over.

In the other illustration the box is lying flat and cannot be moved even though the reamer should stick in the hole. Both the machinist and the helper are holding the motor in the proper manner.

SEAMLESS STEEL TUBES.—The 23-page booklet of the Globe Steel Tubes Company, 1345 Burnham street, Milwaukee, Wis., pictorially describes the operations and equipment necessary for the manufacture of Globe seamless steel tubes which are produced from solid billets of basic open-hearth and electric furnace steel. Special reference is made to the locomotive field, also to miscellaneous applications of steel tubing in electric railway and constructional work.

Interest Increases In Work of General Foremen

Convention attracts higher railroad officers—Car, locomotive and stores subjects discussed

AFTER a four-day meeting of unusual educational value the International Railway General Foremen's Association brought to a close, on September 20, 1929, one of the most constructive conventions ever held by that organization. This year's sessions were held at the Hotel Sherman, Chicago. The total registration was 624 of which 178 were members of the association and 167 were guests—railroad mechanical officers and supervisors. That the association is exerting a wider influence each year is indicated by the caliber of the men that it has been able to attract as speakers and the attendance of higher mechanical department officers.

The outstanding address of the convention was that made by A. R. Ayers, general manager, New York, Chicago & St. Louis at the opening session. At later sessions addresses were made by L. C. Thompson, general manager of stores, Canadian National, and Isaiah Hale, safety superintendent, Santa Fe System. With the exception of the opening session each of the sessions was devoted to the presentation and discussion of a single topic, as follows: "Inspection and Lubrication in Relation to Long Runs"; "Repairing Locomotives Other than Steam"; "Saving by Modern Shop Production Methods"; "Reducing Material Delays by Proper Programming"; "Draft Gear Inspection and Maintenance" and "The General Foreman's Contribution to Safety First".

The following officers were elected to serve during the year ending September, 1930: President, H. P. Sunderman, general foreman, Hocking Valley, Columbus, Ohio; first vice-president, A. H. Keys, general foreman, car department, Baltimore & Ohio, Pittsburgh, Pa.; second vice-president, A. T. Streeper, general foreman, locomotive department, New York, Chicago & St. Louis, Conneaut, Ohio; third vice-president, W. J. McCloskey, general foreman, car department, Illinois Central, Centralia, Ill.; fourth vice-president, C. M. Hillman, shop superintendent, Minneapolis & St. Louis, Marshalltown, Iowa, and secretary-treasurer, William Hall, Winona, Minn. The retiring president, J. H. Armstrong, was elected to the chairmanship of the executive committee along with the following members: F. M. A'Hearn (B. & L. E.); C. A. Barnes (Belt Ry. of Chicago); H. E. Warner (N. Y. C.) and J. A. Elliott, (Illinois Central).

The officers and the Executive Committee of the General Foremen's Association

Left to right—Wm. Hall, secretary-treasurer; C. A. Barnes (Belt Railway of Chicago); J. H. Armstrong (A. T. & S. F.), president; W. J. McCloskey (Illinois Central); H. B. Sunderman (Hocking Valley), first vice-president; F. M. A'Hearn (B. & L. E.), chairman, Executive Committee; A. H. Keyes (B. & O.), second vice-president; A. T. Streeper (N. Y. C. & St. L.); C. M. Hillman (M & St. L.), fourth vice-president, and H. E. Warner (N. Y. C.)

The President's Address

President Armstrong, in his address, drove home to the members the importance of the job that is ahead of the supervisors on American railroads in the coming years. He drew attention to the increasing competition which railroads are meeting in soliciting freight and passenger traffic and that the real opportunities for increasing the profit from railway operation are in the effectiveness of the economies that are brought about as the result of better operation and maintenance. He pointed out that "there is a constant urge for lower

rates. The railroads can meet this reduction in rates only with a reduction in operating costs. We, as foremen, should take stock and ascertain whether or not we are doing all we can to repair and keep in service at the lowest cost the locomotives and cars which are placed in our hands. We must keep abreast of all the new appliances that are placed on cars and locomotives in order that we may be able to instruct those under us as to the quickest and best method of keeping them in repair."

Mr. Ayers' Address

Two outstanding figures indicate the progress that railroad transportation has made in recent years. Since 1918 the average miles per freight car per day has increased from 25 to 31, about 25 per cent, and at the same time the average consumption of coal per one thousand gross ton miles has fallen from 173 lb. in 1920 to 127 lb. in 1928, a decrease of about 26 per cent. Of course, a great many factors contribute to this improvement and the men charged with designing, building and maintaining locomotives and cars are contributing their full share.

In carrying out the manifold duties connected with the supervision of railroad shops you have, of course, many problems to meet, including costs, quality of work and the training of men.

Remarkable improvement has been made in recent years in the design of locomotive and car equipment and at the same time in the smoothness and solidity of track of the average railroad. These two things, together with the steadily increasing demand for greater speed and reliability of service, have brought about a demand for better standards of maintenance and it seems to me that this is one of your outstanding problems. In saying this I give you full credit for your part in the great improvement which has already been made. From my own experience in locomotive and car shops several years ago I know that equipment is much better designed and maintained today than it was then.

The day is past when locomotives and cars must be loosely put together in order to run successfully and the more closely and more accurately we can fit parts and still have them operate and lubricate properly, the longer they will run before developing excessive pounds or lost motion.

In the early days of heat treating by quenching and tempering considerable difficulty was encountered in connection with railroad equipment on account of the large size of parts. Processes are now being developed which seem to give promise of overcoming this difficulty and it seems to me that your association has a great field in extending the use of hardened and ground parts, and in some cases the parts could be hardened without being ground.

In working these things out we can profit greatly by the experience of automobile manufacturers and machine-tool builders.

There is good reason to believe that use of better material, higher grade workmanship, and hardening and grinding where they can be used to advantage will not only produce better service but will actually lower the cost of maintenance.

Officers of the Association of Railway Supply Men

Left to right—E. H. Weaver (Westinghouse Air Brake Company), secretary-treasurer, and C. F. Weil (American Brake Shoe & Foundry Company), president.

Improving Specialties

Present day locomotives and cars would not be possible without the many specialties which have been developed to perform certain necessary functions. At the same time the maintenance of these specialties has become a very large portion of the maintenance of the equipment as a whole. You can be very helpful in cutting down the cost of maintaining these specialties by calling attention to the parts which wear out or fail and recommending the use of better material or different designs, etc., where you think they can be used to advantage.

I recall one locomotive accessory which is practically a necessity and in which certain rather expensive parts required renewal at each general shopping of the locomotive. With the very willing co-operation of the manufacturers, arrangements were made for these parts to be made of heat-treated material; they now run for several shoppings. There is some increased cost for the heat-treated parts, which is more than made up by the increased life.

With particular reference to locomotives, better design is rapidly bringing about a condition where the operations to be performed at certain classes of shoppings are more nearly uniform, which makes it possible for you to employ more and more the methods of routing material employed by strictly manufacturing shops.

Oftentimes the wear or failure of a single part causes you to tear down a quantity of other work which in itself is capable of much more extended service. The men in the shop know more about these conditions than anyone else and you can perform service of great value by calling attention to details of this kind that are usually easy to remedy if the conditions are known and when taken care of, do much to reduce your costs and to simplify and make more uniform the movement of the work through your shops.

Periodic Shopping of Freight Cars

I should like to get across one message to the car men in particular. I have sometimes thought that a car foreman was his own worst enemy in turning out cars in such condition that it is only a question of a short time until someone will have to take them in on the repair track again.

I am very willing to agree that the design of cars in the past probably made such methods the only ones possible to employ to keep the cars moving at all. But times have changed, cars as built today have the trucks,

underframes, draft gears and couplers substantially designed so that with proper maintenance they will run a long time with very few repairs.

It is common practice to shop locomotives on a mileage basis and to shop passenger cars on a basis of regularly assigned number of months service between shoppings. In the past this has not been practical with freight cars but the time has come when it is practical and in my opinion, it is desirable and even necessary to follow such a practice.

Several roads, of which the system with which I am connected is one, have adopted the policy of giving freight cars general repairs with a definite expectation of a certain number of years' service before another general repair becomes necessary. This length of service varies from six to ten years according to the class of repairs.

That such a period of service between shoppings is entirely feasible was definitely proven to our satisfaction by the performance of a lot of 1,000 box cars built in 1916 and which, for a period of 10 years and in some cases even longer, required nothing more than running repairs except, of course in a few isolated instances, such as accident, etc.

Similar to the practice of other roads we assign certain classes of cars to certain shops for general repairs and our mechanical department people readily agreed that if these cars were thoroughly overhauled there was no reason why they should not give nearly as much service as a new car before they would again need a similar overhauling.

For about a year and one-half we have proceeded on this basis and have every reason to believe that the expected results will be obtained. Record is made of the cost of labor and material for each car receiving such a general repair and the car is stencilled to show the date and place of general repair. Instructions are in effect that such cars shall not again be given general repairs prior to the expiration of their scheduled term of service without first taking up with the master car builder.

This practice, of course, requires the renewal of a small percentage of material that might give some further service. In most cases, however, such material can be used for running repairs and we feel that better condition of the car over a period of years and greater freedom from repair track movements will more than compensate for the slight additional cost of making the complete general repair.

Condition Freight Cars for Long Runs

Continuous long runs of passenger cars amounting to 2,000 miles or more have been common for many years and it is very seldom that a passenger car needs any repairs of consequence or is required to be taken out of a train in the course of such a run. Long runs of locomotives are now becoming common in the United States and Canada.

Having in mind the continually increasing demand for faster and more reliable freight service it would be difficult to over-estimate the benefit from an operating standpoint that would result if freight cars were maintained so that they would make long runs at high speed with the same reliability and minimum amount of inspection and repairs at terminals as passenger cars. From an engineering and maintenance standpoint I can see no good reason why this condition cannot be brought about with resulting better service and at even less cost than at present, and I should like to leave that thought with the members of this association for your very serious consideration.

Inspection and Lubrication in Relation to Long Runs

The inspection of equipment is an important part of train operation, in fact it might be considered as one of the most if not the most important phase of this work as without proper inspection the efficiency of a device no matter how thoroughly constructed, would be destroyed. It is therefore important that competent, conscientious men be assigned and that they be given every facility for proper performance of their duties.

Equipment should be so constructed that all parts are accessible for inspection without loss of time or undue expense. However, no expense should be spared to assure the service condition of all parts that are inaccessible and a proper system of inspection be arranged to suit service requirements.

Methods Recommended to Fit Locomotives For Long Runs

Driving and Truck Journals—The application of floating type bearings lubricated with semi-solids or grease gives good results, but it is necesary and desirable to provide grease storage space in the form of numerous small holes or cavities with suitable grease grooves leading to the bearing surface. The larger cavities fitted with plungers and springs force the grease to the bearing surface and by means of indicators can be inspected at terminals by inspectors.

Trailing and Tender Truck Journals—These are inspected and lubricated in accordance with A. R. A. standard practice. They should be examined and repacked as often as service requirements demand. On a number of roads it was found that they were repacked each 15 days in summer months and each 30 days during winter months.

Side and Main Rods—These are lubricated with special grease and grease cups forged solid with the rods. These cups are fitted with solid caps which have been found preferable to plungers and springs; especially when exposed to snow and ice, these are difficult to maintain. Main pin bearings are fitted with floating bushings with the necessary holes in the bushing to provide storage space for the grease. Grease cups should be inspected and refilled at terminals.

Valve Motion—A variety of oiling systems have been developed in connection with valve motion. The Alemite system is being adopted by a number of railroads and is giving entire satisfaction and when provided with storage space, will run from terminal to terminal, where they are inspected and refilled with a suitable grease gun or pressure device.

Crossheads—Crossheads and guides are lubricated with oil. A regulated oil feed that is inspected by enginemen, and oil added as required enroute is satisfactory.

Pistons and Valves—Owing to the high temperature and superheat a good quality oil with a high flash point should be used and can best be applied by means of a mechanically operated lubricator which can be regulated to feed oil in proportion to the speed of the moving parts and stops the supply when the engine is at rest without any attention on the part of the engineman. The adjustments of mechanical lubricators should be regulated by enginehouse forces only under the direction of a competent mechanic or supervisor.

Spring Gear—The Alemite system is in use on a great many railroads for this purpose and appears to be giv-

ing excellent service. Grease, when used with this system, is replenished usually once each three months.

Air Compressors and Feed-Water Pumps—The steam cylinder is usually lubricated by means of a hydrostatic lubricator that is supplied with ordinary valve oil and is inspected, filled and regulated by the enginemen. On some roads the inspection, refilling and regulating is done at the enginehouse. The air cylinder is best lubricated as recommended by the air brake companies. The water cylinder of feed-water pump is not usually lubricated other than by contact with water that is being pumped.

Stokers—The general practice of lubricating stoker-engine cylinders is with a hydrostatic lubricator, the same as is used on steam cylinders and air compressors. All other bearings are equipped with oil cups and oil pipes and should be inspected and filled by enginehouse employees or enginemen.

Boosters—Steam cylinders are generally lubricated by means of hydrostatic lubricators the same as steam cylinders on air compressors. The main housing bearings are packed with dope and given the same attention as the bearings on the trailing truck. The gear transmission casing should be filled with car oil, the water drained off and the oil replenished each week in winter and each six weeks in summer or as often as service requirements permit. Boosters should be maintained by enginehouse employees.

Dynamos—These should be lubricated with oil or grease with suitable cups as recommended by the manufacturer. Oil seems to be preferred as the most satisfactory lubricant. The inspection should be made at engine terminals and lubrication applied by either enginemen or enginehouse forces.

Air Brake Equipment—This equipment usually requires no lubricant other than is required when repairs are made or special inspection justifies the application of packing leathers and the most satisfactory lubricant recommended is that furnished or recommended by the manufacturer. Special instructions and tests should be made at terminals by enginehouse employees.

Locomotive Crew Assignments

In getting away from the regular crew and regular engine, some opposition will be encountered, not only from the men actually running and firing the engine but from the transportation and maintenance department employees, more from a dislike of changing an established practice than for any other reason as in most instances when the necessary co-operation has been obtained in operating engines on longer mileage all concerned have seen the advantage and the saving derived. Failures in operating locomotives over long mileages can, in most cases, be traced to the failure of some part of the organization to function properly and someone failing to perform his individual part of the work. One of the first and most important things to consider in starting out to increase the length of locomotive runs is to get the idea sold to the men responsible for the success or failure of the project. By this is meant that every employee in the organization must understand and believe that, no matter how small his part, he must perform it precisely and correctly to insure the success of the whole plan. After the mechanical inspection of the engine is assured, the next consideration is the condition under which the engine is to operate. These conditions must be carefully studied. The engine should be sent out of the enginehouse with all necessary supplies for the trip. The engineman and firemen should come to the engine with the confidence that the service they are starting out on is possible and practicable and that the engine is mechanically fit for that service. At the end of the trip where the engine is cut out for attention it must not be expected that it will be turned back for the return trip until after the terminal forces have had sufficient time to make careful inspection and repairs. The men doing this work must have in mind that it must be done as well as possible so that it will not be necessary to stop for repairs before the final destination is reached.

Each failure should be thoroughly investigated and responsibility placed with the sole idea of avoiding repetition. With this idea well established, greater locomotive mileage can reasonably be expected.

Conditioning Cars for Main-Tracker Freight Service

Freight cars should receive the necessary inspection and care at the initial or despatching terminal to insure reaching destination without further careful inspection. For instance, a loaded car originating or received at interchange from a connection should be carefully inspected to assure its being free from any defect which in the inspector's judgment would prevent the car from reaching its destination, whether that destination be 50 miles distant or 500 miles distant. All running gear should be carefully inspected to see that cotters are open and in place and that no parts are worn sufficiently to require immediate renewal or repairs before the car completes its trip to destination. All wheels, brake beams, hangers, etc., should receive this same inspection. The inspector making this inspection should also see that the lading on the car is in safe condition and loaded in accordance with the A. R. A. Loading Rules. This car having been given a thorough inspection should have a card attached bearing the date, station and inspector's name which will serve the purpose of giving information to other inspectors that the car is in such condition to go forward to its destination without another careful inspection, barring accident or rough handling.

At the various terminals through which the car will pass the inspectors will give only a running inspection to see that nothing is dragging and that loads have not shifted or that no new defects have developed.

Empty cars may receive the same general inspection before being loaded at a terminal and only the lading given a final careful inspection before the car is despatched.

It is essential that a competent corps of inspectors and repairmen be maintained to insure that the car equipment is in safe and serviceable condition to go forward from the initial terminal while a lesser number of inspectors are required at the various terminals through which the car passes enroute to its final destination.

Lubrication of Freight Cars

Journal boxes on freight car equipment should be repacked periodically as required by the A. R. A. Rules, which provide that all boxes must be repacked once each twelve months and so stencilled on the car. It is permissible to repack all boxes when the car is on a repair track for other repairs after nine months.

A competent force of box packers should be maintained to see that all boxes on freight cars meet the requirements of this rule, and that they perform their duties according to instructions. No one cause is more responsible for disrupting main-track movements or long runs than boxes. A careful study of causes resulting in hot boxes develops that they can be sifted down

to a man failure in the majority of cases. If properly prepared sponging is used, sponging which has been properly reclaimed included, the journal box properly cleaned out before being repacked, a standard size roll placed in the back of the box and good, properly saturated packing fed into the box preferably to the center line of the journal and packed firmly with no loose ends hanging out it may reasonably be expected that the box will not run hot due to lack of lubrication. In transportation yards where box packers and oilers are provided to remove the front pieces from the boxes, set the packing up against the journal, leaving no hollow places in the back, add the required packing or oil, replace the front piece, being careful not to push it under the journal, boxes should give no trouble. We mention not pushing the front piece back under the journal for the reason that this piece of waste is only intended to catch cinders, grit and dirt and keep it from working back in the box and if pushed under the journal it is liable to cause friction.

Another important factor in the preparation of sponging is the grade of oil used. Most oil companies furnish two grades of car oil one for summer and one for winter. Great care should be exercised to see that oil vats are drained at required intervals, and oil changed at the proper season.

The report was signed by A. H. Keys (B. & O.), chairman, Geo. Duckett (I. C.), G. W. Dabner (Mo. Pac.), L. A. Moynihan (A. T. & S. F.) and S. T. Boone (C. N.).

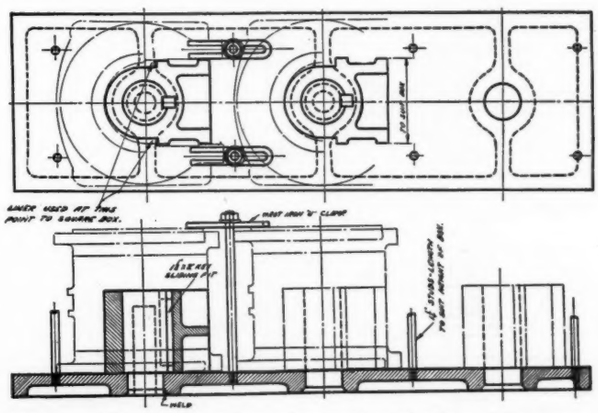
Discussion

In discussing the question of the lubrication of locomotive spring-rigging parts, several members outlined the experience on individual roads with the Alemite pressure system of hanger-pin lubrication. It seemed to be the general opinion that this system of lubrication has contributed to a much greater service life for these pins and bushings. As a concrete example one member told of a locomotive on which the spring pins and bushings were inspected at the shopping period for general repairs after 110,000 miles and were found to be in such satisfactory condition as would warrant replacing them in service. The question was asked as to how many railroads were applying bushings and hardened brake-hanger pins on passenger cars. Many of the members replied that this method had been found to be practicable and that it had been adopted on their roads. In further reference to the question of pressure-gun lubrication, one road was found to have adopted this method of lubricating passenger-car body and truck center plates.

In discussing the subject of main-tracker conditioning it was pointed out that several years ago, before locomotive runs had been extended, freight cars were only expected to run from terminal to terminal but that now they must run from despatching point to destination. Previous to the institution of long runs freight-car inspection forces were maintained at each terminal through which the train would pass on its trip from point of origin to destination. At many of these terminals the train would be broken up and re-inspected. With the introduction of the main tracker and the long locomotive runs these inspection forces were rearranged by placing a sufficient force at the originating or despatching terminal to inspect the train and make sure that it left the terminal in such condition as to reach its destination without further detail inspection except in the case of shifted loads or new defects. To assure that this car had received detail inspection one road has developed a carding system whereby a card is placed on each side of the car, bearing the date, station and inspector's signature, signifying that the car should reach its destination without the necessity of further inspection or repairs. Yardmasters and conductors are instructed not to move cars out of the yard in a train unless they bear this card. The system is said to have proved effective.

Savings by Modern Shop Production Methods

Mass production has solved the problem of the industrial plant and it would seem to be the logical method to employ in railroad shops, but conditions existing in car and locomotive repair work are such that mass production can be practiced only on a very limited scale. There are many different classes of locomotives and cars, making standardization of repair parts a difficult problem. Production must be governed by consumption and it is of little value to produce material in large quantities that will be carried by the store's department for months at a time, steadily increasing the cost but never increasing the value. The manufactured material



Jig for milling driving box shoe and wedge faces on a two-spindle milling machine

that has been paid for and not put to work at once, soon swallows up its value in storage, handling and inventory and for that reason it is unprofitable to manufacture repair parts in quantities when the demand for them is far behind the supply. There are some, however, that help in keeping down th costs and it is to these we would call your attention.

Cost-Saving Operations

Shoes and wedge faces on driving boxes ca nbe machined four at one setting on a two-spindle horizontal milling machine, using face milling cutters and a jig. This method shows considerable saving over the old method of planing.

Shoes and wedges can be machined on a two-spindle horizontal milling machine. Fourteen of these can be machined inside and outside at one set up, using a gang of cutters for this purpose.

A saving can be made in finishing crosshead shoes for the guide fit after they are applied to the crosshead, by using a two-spindle horizontal milling machine and jig. Crossheads are applied to each end of mandrel and face milling cutters are used on the side heads to machine, finishing both sides at one setting.

The introduction of a double-stitch sewing machine into the upholstering shops will greatly increase production of locomotive cab curtains and a saving in labor can be accomplished.

Recently a turret lathe has been placed on the market which promises to be a great aid in producing efficiently and economically, bolts which will fit holes they are intended for whether the holes be tapered or straight, by measuring the hole with plug gages and setting the micrometer dial on the machine to correspond to the micrometer graduations on the plug gage. These bolts can be turned with one cut and prove correct in both diameter and taper, showing a substantial saving over the old method of finishing on engine lathes.

The value of wheel lathes, tire mills, multiple bolt machines, forging machines and electric flue welders, is well known and they might be classed as profitable single-purpose machines, because the demand for their product is always ahead of the supply and insures continuous operation of these machines.

Savings in Car Work

Cost cutting is not a question of machines alone. Improved working methods have been an important factor. The most important development in this line is the progressive system of car repairs. This plan has brought about a revolution in car repairing in practically all parts of the country. It has increased shop production to such an extent as to insure its superiority over any of the older methods. In shops where it was previously an effort to maintain a schedule of 100 to 125 cars a month, it is now possible to turn out 350 to 400 cars a month, with approximately the same labor allotment on actual construction. Under the progressive plan, cars are worked through the shops in a certain number of spottings, depending on shop facilities and on the construction of cars undergoing repairs at each spot, such as stripping, truck work, draft gear, steel work, safety appliances, painting, etc. A reasonable time allowance is set for each spotting and it can readily be seen that a delay at any certain spot means the tying up of the line, resulting in lost man-hours at each of the other spots. Of course at times and under certain conditions it is necessary to increase the force on some particular spot in order to prevent such delays. However, if a certain class of equipment is moving through the line, the forces can be gaged in such a manner as to render such delays a rarity.

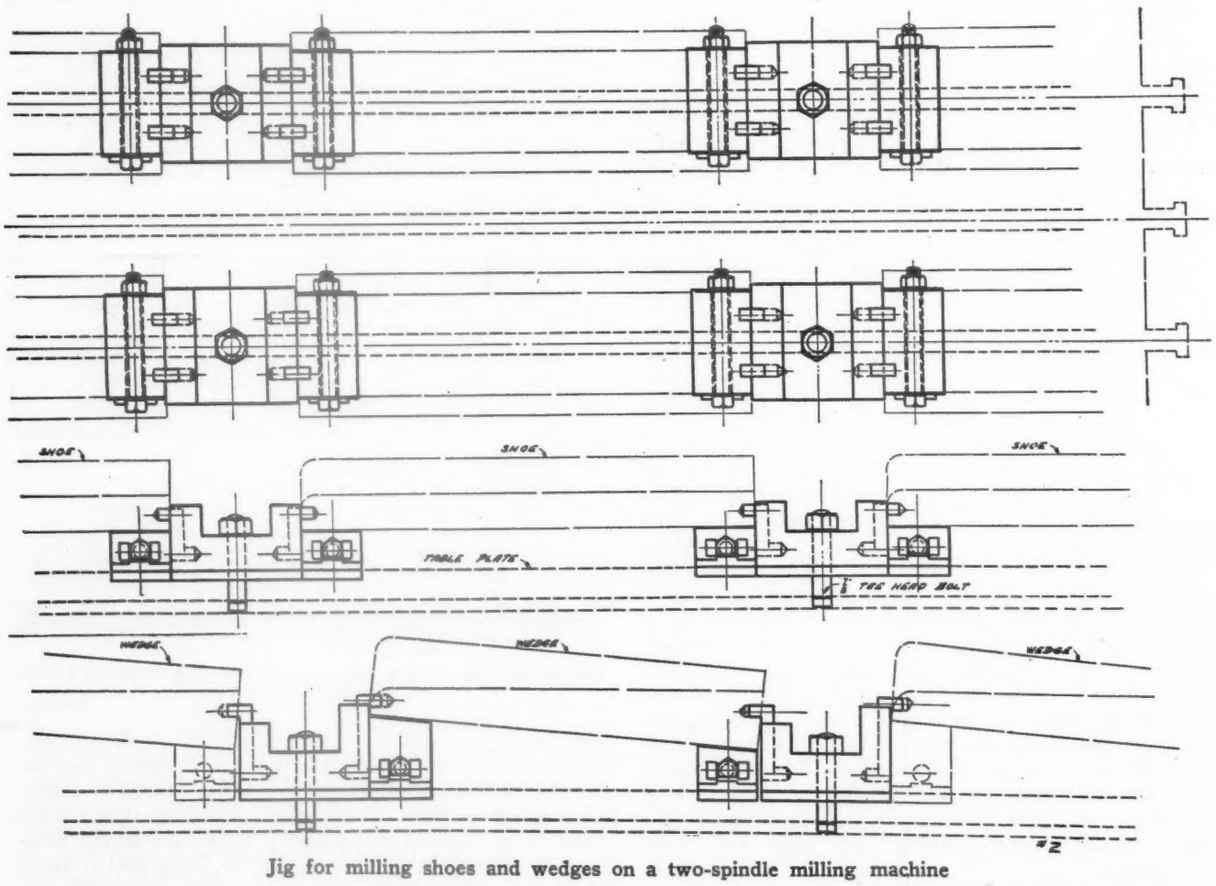
In one shop where three progressive lines are being maintained, cars are divided in line as follows:

In the first line are wood flat, coal and box cars in series; second line, steel hopper cars; third line, composite box, coal and flat cars. On the first and third tracks six spots are used before a car goes to the paint shop, as follows:

First—Stripping.
Second—Truck and center-plate work.
Third—Draft gear.
Fourth—Steel work.
Fifth—Wood work.
Sixth—Safety appliances.

In working the steel hopper cars, seven spots are required, not including painting:

First—Stripping.
Second—Truck and center-plate work and draft gears.
Third—Side- and end-sheet application.
Fourth—Bottom sheets already riveted in quarter section.



Jig for milling shoes and wedges on a two-spindle milling machine

Fifth—Reaming and riveting of bottoms of frame.
Sixth—Riveting sides and ends.
Seventh—Hanging doors and safety appliances.

The major contributing factors in shop savings through this progressive plan are: first, material is placed adjacent to the spot where it is to be utilized and, second, each group of workmen has one particular line of work and a specified limited time in which to perform it; hence, these men become skilled and efficient in that particular line.

Another prime factor is that in working certain series of cars through the shops, the mill work and fabrication is for that particular class of equipment. After machines are set for this work, no changes are necessary until another class of cars is started through the line. There is no question but that the progressive plan, so successful in industrial plants will eventually become successful in railroad repair shops.

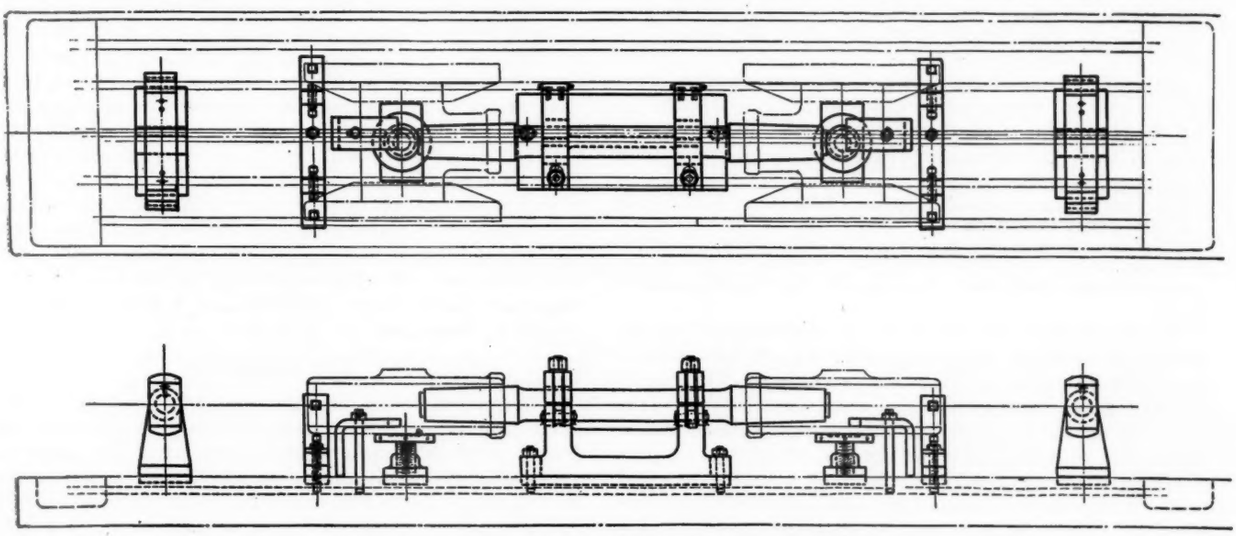
In the rush of production, one feature of economical shop operation that is too often neglected is the transportation of supplies and raw and finished products. At no point in shop operation is there a call for more efficient or scientific handling than in this same department, whether or not it is equipped with modern tools and machinery for producing parts in quantities for locomotive and car repairs.

Modern methods are useless if the means of distributing the finished material is inadequate. Overhead cranes, air and electric hoists might be classed as fixed conveyors because of their limited range. Electric platform and crane trucks and hand trucks constitute the more flexible style of conveyors in use. The flexibility of the electric truck makes it a most important factor in handling material. Especially is this true of the crane truck—it releases the overhead crane for the heavier work.

The report was signed by A. E. Iveson (N. Y. C.), chairman, H. L. Arnold (I. C.), and J. A. Elliott (I. C.).

Discussion

One of the most pertinent comments made during the discussion of production methods came in the form of a question: "Why the necessity for production?" The member who asked the question explained that he did not want this question interpreted in such a manner as would indicate that he was not in favor of modern methods but he wanted to find out how many of the general foremen appreciated the real value of the situation, in any shop, which necessitated the production of many car and locomotive parts on a quantity basis. As an example he pointed out that in one large shop there had seemed to be a demand for a great increase in the production of bolts that were at one time used for bridge and car truck work. It occurred to the man in charge of the shop that it was strange that there should be such an increased demand for the bolts in question when practically all bridge work is riveted and not bolted, and that with the introduction of cast-steel truck side frames there really should be a diminishing demand for truck bolts. Investigation disclosed that many of the bolts manufactured were being wasted and a check-up brought the demand down to a point well within the capacity of the existing machines. Production methods in modern locomotive and car shops, several speakers indicated, should come as a result of new methods and modern machines and that a very careful analysis should be made of all costs involved when putting a job on a production basis in order, first, to make sure that the increased output is really necessary and, second, that it can be secured at a lower unit cost.



Arrangement of jig for milling crossheads and shoes

Draft-Gear Inspection and Maintenance

Your committee has made inquiry of several roads in the different parts of the United States and Canada in an endeavor to learn the practices of these roads in addition to the ones on which your committee is employed. The replies received convince us that the inspection and maintenance of draft gears on freight equipment does not parallel the care and attention given air brakes, running gear, and safety appliances.

Our experiences and inquiries show that the improvement in friction draft gears as developed through the years by the several manufacturers, compares very favorably with the improvements made in recent years on trucks, roofs, foundation brakes, superstructure, etc., considering, of course, the limited space in which they were allowed to develop a gear of sufficient capacity to

cope with long trains and shocks the gears are subjected to in present yard service. Your committee believes that car builders and designers are to a great extent to blame for the inadequate draft-gear protection on our otherwise modern car today.

It is well known to all that the draft gear is always in service when the car is in motion and subject to ordinary wear and tear in fair service and also many times subject to rough handling loading it far beyond its capacity, causing failure to the gear itself and, in many cases, to the sills that contain it, the superstructure of the car, its lading, and cars that are associated with it. This failure may not be complete at the time but sufficient to allow the shocks that are transmitted afterwards that should be absorbed by the gear to be taken by the car and its contents, causing damage to both car and lading. The result is that the gear itself must be renewed, damaged parts of car repaired, and claims paid on lading.

It is the opinion of your committee that a large saving can be effected if some feasible inspection period can be determined by the railroads and private car owners. We do not feel that we are in a position at this time to recommend when and how this inspection should be made, or what the A. R. A. cost should be to the railroads, and request that this organization take this matter up with the Mechanical Division of the A. R. A. asking them to study this matter, making a report to their organization after they have come to a final conclusion on the following:

The time the gear should be inspected by removal after new cars are placed in service.

What amount of slack is permissible on gears to be turned to service.

After the first inspection, when should the next inspection be made?

We recommend to the A. R. A. committee studying this feature that no cars be considered except those built new after January 1, 1927; that in studying the feature of draft-gear maintenance and inspection they have in mind an A. R. A. price for this work. It is also the opinion of your committee that new cars should be permitted to run for a longer period of time before first inspection by removal than cars receiving the second inspection, except in cases where complete renewals are made to the gear and the stencilling on the car so states.

It is also the opinion of your committee that the car should be stenciled showing the date when the draft-gear inspection was made similar to the practice now in vogue when cars are reweighed, and the packing of freight car journals as it will be handled after January 1, 1930.

The Mechanical Division is in a position to make a complete report on this matter as they cover the whole country and it is entirely too difficult a problem for a committee such as yours from one or several roads to handle to conclusion with any degree of intelligence or satisfaction to the car owners involved.

We believe the following are outstanding conditions confronting the railroads due to poor draft-gear maintenance: excessive slack in trains causing air leaks; damage to equipment and lading due to slack action and closing of gears; discomfort and, in many cases, personal injuries to train crews; unseen damage to equipment that has not been directly charged to this source but to ordinary wear and tear.

Upon inquiry of the different roads your committee found that a large percentage of them have no definite time to remove draft gears except when the car is in for general repairs; by this we mean the actual removal of the gear for inspection purposes only. We also find that very few roads stencil their cars after the gear has been removed, showing place, date, and time. The committee realizes the expense that would be incurred by the removal of draft gears every four years, but we are agreed that this important part of the car should be inspected by removal at specified times and that the A. R. A. should set up a maximum amount of slack allowable on gears to be retained in service and the cost for renewals, adjustments, and replacements set up and apart from the prices used on ordinary repairs, definitely determining a time for inspection similar to that used in the reweighing of new equipment and equipment that has been in service over the period specified in Rule 30.

Taking for example the rules and regulations covering inspection and renewals of wheels, we find that since the organization of Master Car Builder's Association this has been a vital subject. Committees have submitted volumes on the handling of wheels; diagrams of the several defects that occur to them were furnished, gages provided and, in a thorough manner, all conditions surrounding wheels and their defects were incorporated in book form, this first being handled by the old M. C. B. Association and at present by the Mechanical Division of the A. R. A. But in going through this organization's data on draft gear we find it to be meager, and we hope that we may in some way be the means of bringing this forcibly before the attention of our managements, and that a code of rules will be set up covering draft gears that will compare favorably with Rule 86 covering wheels and Rule 60 covering air brakes; that a definite time limit for removing be established; and that gages be designed for measuring slack.

The report was signed by W. J. McCloskey (I. C.), chairman, Jos. Gullage, (B & M.), E. J. Burck, (M. C.), and C. F. Baumann (C. & N. W.).

Discussion

The general trend in discussion of this report indicated strongly the majority opinion that the lack of proper inspection and maintenance of draft gears is responsible for a substantial proportion of present railroad damage claims and extensive damage to equipment, the amount of which is hard to determine. Several members stressed highly the commendable work of the manufacturers who have, within the present draft-gear space limitations, developed gears of remarkable effectiveness. One member asked if the provision of a longer inspection period for gears in new equipment than in old equipment would not result in undesirable confusion. Other facts brought out on the convention floor were that rough handling of trains frequently charged to overloaded locomotives is in reality due to the failure of draft gears to perform their proper function.

It was also stated that the increase in the proportion of composite and all-steel cars which are relatively rigid in design increases the necessity for effective draft gears. In closing the discussion, Chairman McCloskey said that cars have increased in capacity to 100 tons and more and journals doubled in size without any increase in the 24⅝-in. space allotted for draft gears. He urged that railroad men in considering this detail of car design look to the future when still higher capacity cars and longer trains are probable.

The committee report was accepted and it was voted to recommend to the American Railway Association, Mechanical Division, that some definite time limit be adopted for the periodic inspection and repair of draft gears.

Tool Foremen Hold Constructive Convention

Annual meeting addressed by two mechanical department heads—Numerous effective shop devices suggested

At the seventeenth annual convention of the American Railway Tool Foremen's Association held at Chicago, September 11 to 13, inclusive, the usual constructive committee reports were presented. The meetings were conducted by President W. R. Millican, tool foreman, Missouri-Kansas-Texas, Parsons, Kan. Numerous addresses, including two by mechanical department heads, helped to focus the attention of the association members on the importance of effective toolroom organizations and their vital relation to efficient railway operation.

The high points of the 1929 convention were addresses by E. B. Hall, general superintendent of motive power and machinery of the Chicago & North Western, and C. M. House, superintendent of motive power and equipment of the Chicago & Alton. Mr. Hall said that the railroads have been laboring under severe competition and that their success in meeting new problems is dependent to a considerable extent on the maintenance of equipment, in which work the tool foremen play a highly important part. He quoted the familiar expression that "a good workman is known by his tools" and said that tool foremen have a splendid opportunity to contribute to increased efficiency by familiarizing themselves with specific problems in all the various shop departments and developing better tools to meet these respective needs. He referred particularly to the necessity for modern heat-treating equipment and methods in the toolroom in order to get the most out of the high-speed tools now generally used.

Mr. House emphasized particularly the necessity for tool foremen not only to furnish the proper tools for railway shop use, but their obligation to help educate shop men in proper use of these tools. Implying that none are in a better position than tool foremen to suggest necessary improvements in machine tools and recommend the best sizes and designs for different classes of work, Mr. House said: "Do we know when it would be profitable to replace an old machine with a new one? Do we know what per cent should be realized on the investment to warrant the purchase of a new machine? This should be of interest and has great possibilities. Your association has given valuable assistance in the selection of the proper machines, furnaces, etc., for the manufacture, repair and hardening of tools in your departments. It is essential that the tool department have the proper equipment, for you cannot make modern tools economically with obsolete machines, and no matter how well a tool is designed and made, if not properly hardened, it will fail in service. In order to harden tools properly, you must have the proper equipment."

Mr. House also made a strong appeal for "Safety First" through the use of greater care in the design and manufacture of tools to minimize the possibility of failure and resultant accident. Mr. House closed his remarks with the statement that today the efficiency of a shop is judged by the number of years of unfailing service built into equipment at the lowest cost per mile and that tool foremen as a result of their training and experience, are a big factor in contributing to this standard of efficiency.

Following the opening address by President Millican, M. D. Chase, shop superintendent of the Missouri-Kansas-Texas, Parsons, Kan., addressed the convention, maintaining that the success of tool foremen hinges on three important factors: First, support and confidence of their superiors; second, a detailed knowledge of tool problems confronting each of the shop departments; and, third, their ability as supervisors and instructors. Mr. Chase said that tool foremen must think, talk and act "Safety First." They must be prepared to work out to a satisfactory conclusion the undeveloped ideas regarding labor-saving devices suggested by shop men in the various departments. Frequently someone in the shop gets a good idea but has not the time or the skill to work it out. In that case, the tool foreman must step into the breach and see to it that the idea is not lost, as so often happens, but fully capitalized to the benefit of the shop and the railroad. Mr. Chase said that the association has only scratched the surface in simplification and standardization of railway-shop tools and urged that further constructive work along this line be undertaken without delay.

An instructive address on milling cutters was presented by A. N. Goddard, president of the Goddard & Goddard Company, Detroit, Mich., an abstract of which is included elsewhere in this issue.

Committee reports were presented as follows: "Standardization of Boiler Tubes," chairman, A. A. Ferguson, tool supervisor of the Missouri Pacific, St. Louis, Mo.; "Methods and Tools for Repairing Air Brake Equipment," chairman, C. C. Kuyper, tool foreman, Illinois Central, Chicago; "Locomotive Shop Jigs and Devices," chairman, L. R. Denst, tool foreman, Chicago Junction Railway, Chicago; "Tools and Equipment for Car Repairs," chairman, E. S. Behen, Missouri-Kansas-Texas, Sedalia, Mo.

Election of Officers

At one of the regular sessions during the convention, the following were elected officers of the American Railway Tool Foremen's Association for the coming year: President, A. A. Ferguson, tool supervisor of the Missouri Pacific, St. Louis, Mo.; first vice-president, H. L.

Taylor, supervisor of shop machinery and tools, Baltimore & Ohio, Baltimore, Md.; second vice-president, J. T. Jones, tool foreman, New York Central, Collinwood, Ohio; third vice-president, D. L. Grady, tool foreman, Atlantic Coast Line, Rocky Mount, N. C.; secretary-treasurer, G. G. Macina, Chicago, Milwaukee, St. Paul & Pacific, Chicago. The executive committee consists of the following: C. A. Shaffer, general supervisor of shop machinery and tools, Chesapeake & Ohio, Huntington, W. Va.; W. J. Davidson, tool foreman, Atlantic Coast Line, Waycross, Ga.; L. C. Bowes, general piecework supervisor, Chicago Rock Island & Pacific, Chicago.

Efficient Milling Practice

By A. N. Goddard
President, Goddard & Goddard Company, Detroit, Mich.

To keep our great traffic and transportation industry in condition for its herculean task, the safe, rapid and economical transfer of people and commodities from one end of this continent to the other, and, to keep their lanes of travel open and safe requires men, machines, equipment and organization, little dreamed of by the masses of humanity that jam our railway stations or the thousands of helpers who handle the freight.

Some of you men are tool supervisors in the greatest and most progressive railway shops of the world. Under your supervision come the master tools of industry that keep the iron horse in order for his task. You are responsible for the right selection, the proper installation and the correct use of the millions of dollars worth of this equipment.

Efficient Cutting Tools Essential

What message can I bring that will encourage, stimulate or help you in your work? Your mind is full through the busy hours of the working day—yes, and many hours not included in the working day—with the problems of machine tools, conveying equipment, handling equipment, holding equipment, jigs and fixtures, and last, but by no means least, cutting tools—the actual working tools that must bring symmetry, precision, exactness or dimension and contour from the rough casting or the ungainly forging.

Dean Kimball, a few years ago, for the first time in shop history elevated machine tools to the dignified position they rightly deserve by naming them "the master tools of industry."

Granting them the full glory, however, of such a pedestal, what shall we call the cutting tool, without

which the master tools of industry become but mere ornaments in a shop ensemble?

Cutting tools certainly are the necessary and absolutely indispensable complement of the machine tool. They are the medium through which all the energy the machine tool is capable of developing is transformed into units of finished work. In importance they equal, if not exceed, the machine tool. Go back to the beginnings of the race when the cave man first formed his rude stone hut. Did he not first form from a hard stone or flint, a rude cutting tool with which he then roughly chipped the softer stones to make his abode; with which he gouged out the log to make his boat; with which he fashioned his bow and arrow, and spear; with which he scooped out the hollow in a rock in which to grind his wild grain?

After he discovered iron and copper in the earth, did he not first fashion therefrom cutting tools far superior to his first tools of stone? We laugh at them today but rather should we treat them with a fine respect, the forerunners of our modern tools.

For how many centuries did our forbears have the cutting tool as a hand implement before his ingenuity devised a mechanical means of using it?

What was the first lathe but a spindle with a twisted hemp cord wound tightly around it, one end fastened to a foot treadle and the other to a birch sapling so that by foot action the spindle could be rotated a few times as a cutting tool was applied to a piece of wood to give it better shape and with less labor than the slow hand whittling?

C. C. Ziegler (Greenfield Tap & Die Corporation), past secretary and president elect of the Tool Foremen's Supply Association

Cutting tools, perishable tools, small tools, so often the emphasis on small, and oh so often the inference that they are of secondary importance. "Let George look after them." "Don't waste much time or spend much money on them."

Small Tools Not of Secondary Importance

It's a viewpoint 100 per cent wrong! It's a viewpoint of ignorance or indifference absolutely untenable by any shop executive who hopes to be worthy of his position. "George looks after the small tools, you'll have to see him about them." How often do our sales representatives hear this remark! Well, thank God for this convention of "Georges" today and for the host of brethren you have throughout the country. And take to yourselves the dignity and importance of your calling—the selection, care, maintenance, and right use of small tools, drills, reamers, taps, dies, boring bars, lathe and planer tools, milling cutters, cutting tools —the indispensable tools of industry.

How do you select them? On price, prejudice or performance? Let's not forget our earlier remark "The cutting tool is the medium through which all the energy of the machine tool is transformed into units of finished work."

It is finished work you want, of good quality and at the lowest cost obtainable. Note the following factors in the cost of finished work: Capital investment in the machine tool; rental of floor space occupied; heat, light and power to drive the tool; depreciation; auxiliary fixtures for holding work; the cutting tool; work hours.

Of these seven enumerated factors, it is obvious that the last item "work hours" is the most important. It is the live factor; it is the highest single factor. Dependent on the character and ability of the operator, not only his time, but the combination of the other six factors prove an hourly asset or a liability. Hence, whatever can be done to reduce hours of labor on a piece of work or get more pieces of finished work per hour will increase the assets of all the factors involved. The machine tool must be right for the job; rigid enough to securely hold the work, and powerful enough to drive the cutting tool. The work must be effectively anchored, and then, the cutting tool.

Let's give a little thought to the cutting tool:

It must be of the best steel available for the purpose.

It must be designed for the most free removal of metal.

It must be heat-treated for maximum service; that means a combination of hardness and toughness hard enough to cut glass tough enough to withstand 300 Brinell test heat-treated alloy steel.

It must have rake angles of cut such as to part and curl the chip with least resistance.

It must have abundant room between cutting points to prevent chip packing.

It must have clearance enough back of the cutting edge to allow free cutting without rubbing, and no more.

It must have the cutting edge backed up to give maximum strength of tooth and also to carry away the generated heat.

It must have the cutting edges (if the cut is broad) pass progressively over the work; i. e., the cutting lips must be on a helix angle if peripheral cutting, or spiral angle if face cutting.

All these points of design must be properly balanced in a tool in the light of the work a given tool is planned for.

Tools Must Be Designed for Special Jobs

It is obvious that the same combinations of design do not fit tools for all classes of work. In other words, cutting tools for a variety of purposes cannot be made to a single design and be efficient. Hence, the demand today is becoming more and more insistent for the tool designed to fit the job.

These few points merely touch the high spots of tool design and are points you should look for in the tools that come into your hands for service.

Your part in co-operating with the tool designed for your own maximum benefit is the proper use of that tool. You have bought it for service; then give it an intelligent opportunity. Require operators to use arbors of good tough steel that are up to size and run true; to use heat-treated steel (not cast iron) bushings whose sides are parallel and flat; to use good keys, up to size and long enough to extend through the cutter hub and into the bushing on either side. Run the cutters at speeds and feeds that are adapted to the character of material and nature of cut being taken.

If cutting steel, use a heavy flow of compound or a good supply of cutting oil.

Pay heed to clearance back of the cutting edge—that is one of the commonest causes of failure of cutting tools. What shall it be on a milling cutter? No single answer can be given.

This little item of clearance, so often slighted, is of major importance and a half-dozen factors determine it: Feed, speed, depth of cut, nature of material being cut, rigidity of set-up of both machine and work, character of work, whether heavy or light. Clearance may

and does vary from 2 deg. to 15 deg. Remember the basic rule—Back up the cutting edge all possible without the heel of the tooth rubbing.

Longest life between grinds, more continuous hours of service, less "out time" for maintenance, more square inches of finished surface per cutter, these are the factors of real economy in cutting tools. Be it twist drill, reamer or milling cutter, none but the best of these indispensable tools of industry will quality.

They may be small tools, but they are vital tools. Neither is their selection, care and use a small or insignificant task. Yours is a big, vital, necessary work. Treat it as such. Attention to details in the sometimes obscure tool shop will just as surely help to spell success for your railroad as courteous and punctual service of the train crew out in front. The trains can't run without you.

Repairing Air Brake Equipment

Much has been said relative to the development of new devices, which no doubt have resulted in simplifying the various operations. The maximum results from the facilities at hand are not being obtained, however, and the efficiency of the workers could be increased.

It is generally conceded that the possibilities of increasing the output does not depend entirely on the workers. Under piece work there is an incentive for the men to obtain the maximum output and also to assume considerable responsibility which properly belongs to the shop supervision. Their own efforts in obtaining output would automatically provide for the furnishing of material and tools with the least possible delay.

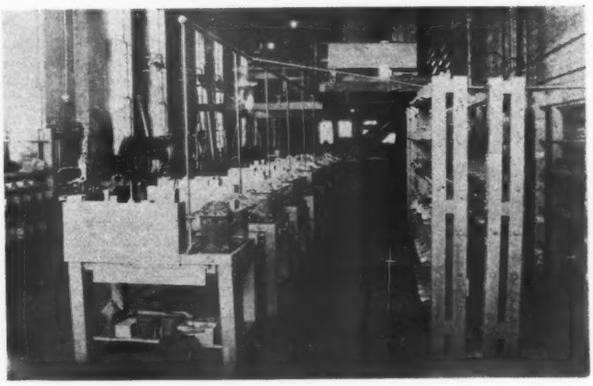
Where the men are paid on a straight hourly basis, the responsibility of obtaining the maximum output rests entirely upon the supervision. It is absolutely necessary to have a complete knowledge of each operation, the time required to each job and consequently the cost of the operation, and this calls for diligent study of all the factors involved.

The biggest factor we are confronted with is the most practical arrangement of facilities, assuming that the efficiency of the workmen and the adaptability of the tools and machinery has been proved. Close observation of the costs of the various operations will automatically suggest ways of improving the general layout to the end that the work most frequently performed can be done with as few movements as possible and that the finished work will be readily accessible to those who will use it.

Another factor is the truism that as time progresses conditions change, and while the lavout and general arrangement may be very efficient today it would not meet the requirements of the service one year hence.

In accordance with the application of these principles, the air-brake shop at Milwaukee shops of the Chicago, Milwaukee, St. Paul & Pacific has been rearranged, the plan of the general arrangement being fully detailed in the accompanying drawing.

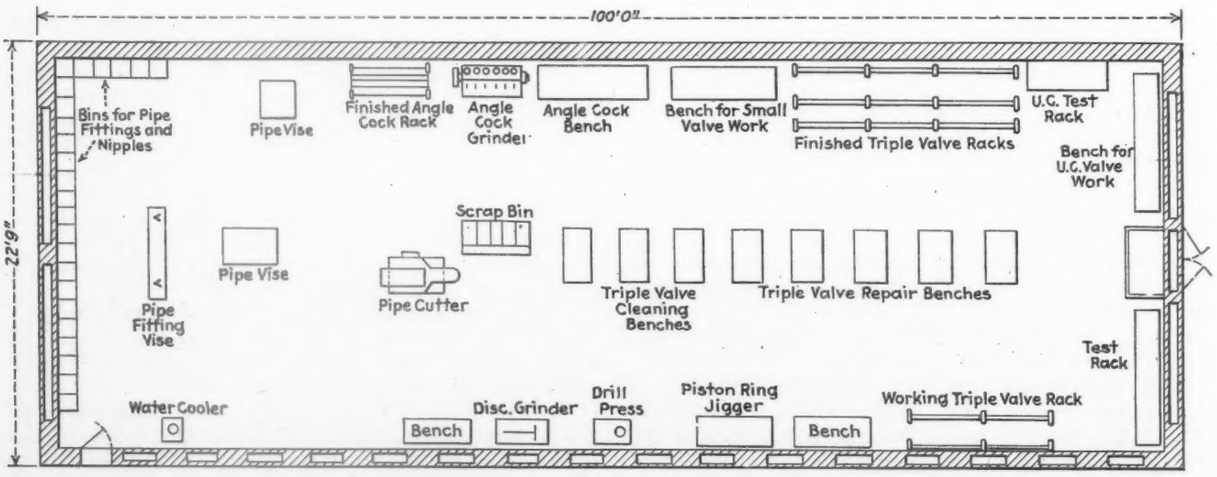
The various operations were assigned distinct classifications and facilities doing the work arranged in such a manner as to prevent one job interfering with another but at the same time providing for work having more than one operation to move forward in its proper sequence with a minimum amount of handling.



Individual triple-valve repair benches at Milwaukee air-brake shop

It will be noted that the pipe work is done in one end of the shop only, and that the tools and supplies are readily available. This is also true in the operation of repairing angle cocks, this work being done with the least possible movement. Small valves such as retaining valves, release valves, small cut-out cocks, etc. are also concentrated at one point, bins being provided for holding these valves before and after repairing.

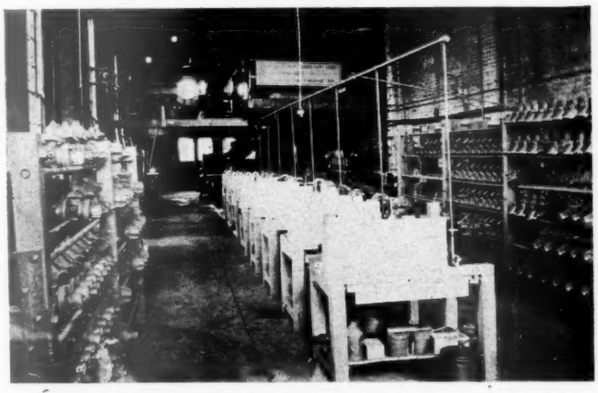
A new departure obtains in the cleaning and repairing



Carefully laid out air room at Milwaukee shops of the C. M. St. P. & P.

of triple valves. Each man now has an individual bench, each bench being fully equipped with a clamping device for holding the triple valve, a complete set of tools and a shelf arrangement on which a supply of gaskets and other small parts are carried. This arrangement, together with the fact that the triple valves are handled between the various operations by a shop helper, makes it unnecessary for the workman to leave his bench for anything distinctly connected with his particular operation.

Racks have been provided for holding triple valves that are awaiting repairs and valves that are ready for service, these racks being located close to the benches on which the work is performed. Directly opposite the



Triple-valve storage racks for incoming and for repaired valves—Milwaukee air-brake shop

repair benches is a bench on which is placed large face plates for spotting slide and graduating valves and piston rings. Next to this is the machine used for lapping in piston rings. All of these operations being performed with the least lost motion.

With the facilities at hand arranged so as to obtain maximum results observation and study should be made of the various operations with the thought of developing new devices which will save labor and simplify the work.

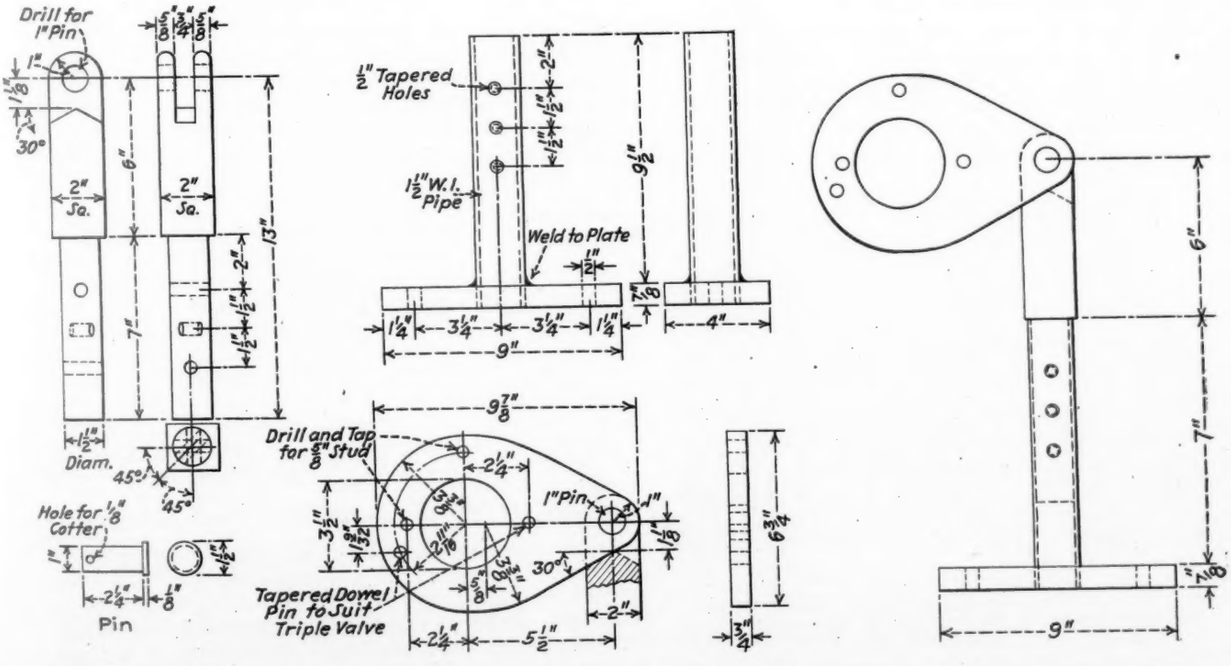
Towards this end, we have collected a number of drawings of devices that have been found very satisfactory and efficient for repairs to air brake equipment and to each of the drawings a complete description of the device and its operation are attached thereto.

[The report was read by Chairman C. C. Kuyper, tool foreman, Illinois Central, Chicago. Only two of the devices will be described in this issue.—EDITOR.]

Jigs and Devices for the Locomotive Shop

As this topic has been a subject for discussion at our convention for the past several years there is not very much that can be added to the committee reports already submitted regarding the development of new jigs and devices other than to submit for your review a number of drawings and photographs of recent developments which have been found very satisfactory and efficient.

From the reports received this year as well as the reports submitted in the past it is our opinion that there are a great many labor-saving devices which are originated at the various railroad shops each year which for some reason or other are never presented at our convention with the result that full benefits are not obtained by a great many who could find some useful work for them. As the object of our Association is the mutual improvement of its members by the general exchange of views along the lines pertaining to railway shop practices so that we can profit by the experience of others in our line of work we feel that there are a great many members who have developed some jig or device which, if exhibited at this convention, would prove of great value to some of the attending members. Therefore, it is our request that if we are to be of greater value to the companies employing us that we all take a personal

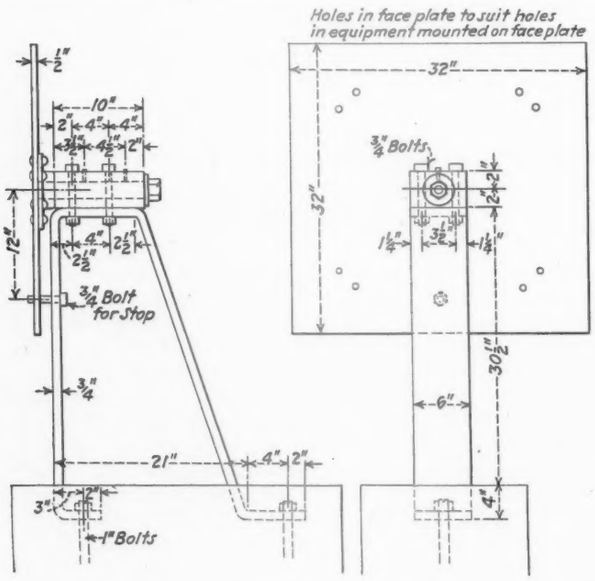


Triple-valve stand which permits working on both sides of the valve at one setting—Union Pacific, Omaha, Neb.

interest in this matter and endeavor to assist the committee appointed next year to the best of our ability.

Device for Lifting a Lathe Chuck

A heavy-duty lathe chuck is a heavy lift for a man to pick off the floor and place on the spindle of a lathe,



Revolving-table rack for use in repairing air compressors—Union Pacific, Omaha, Neb.

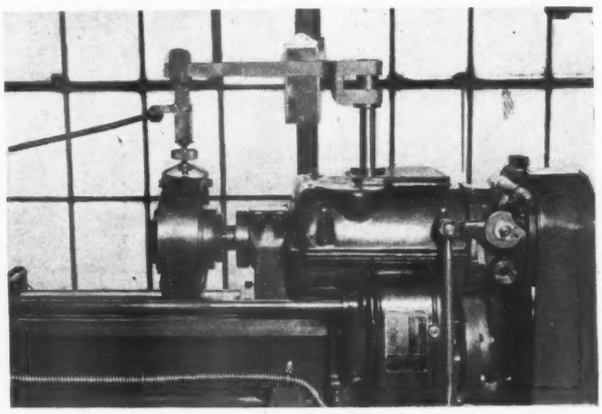
and he is liable to drop it on the shears and bruise them, or mark up the close fit on the nose of the spindle, to say nothing of the injury he is liable to do himself in lifting and stretching over the side of the lathe to get the chuck on or off the spindle.

There is also another point to consider. A chuck handled by the device illustrated, is kept much cleaner than one on the floor beside the lathe and does not get marked up and abused as much.

This device is made up of a piece of ½-in. steel plate which is screwed to the top of the head stock, which in turn is riveted to a post which carries the arm. On the arm is the mechanism for lifting the chuck. In this particular case the chuck has to be lifted five inches in order to clear the shaft which operated the relieving attachment. The illustration shows the chuck being taken off. The chuck weighs 136 lb. and an effort of 18 lb. on the end of the lever lifts the chuck. The chuck can be readily swung to the back of the lathe out of the way and where it will not be abused. On the top side of the knurled grip just above the strap that holds the chuck is a right hand thread and on the bottom side is a left hand thread. After this is assembled washers are put on the ends of the threads and riveted over to prevent accidents by turning to lower the chuck too low thus dropping the chuck. This feature is to adjust the height of the chuck in putting it on or off.

Squaring Valve-Bushing Ports

With the view of increasing the efficiency of our engines and securing a maximum initial steam admission through the ports of the valve cage as the valve passes

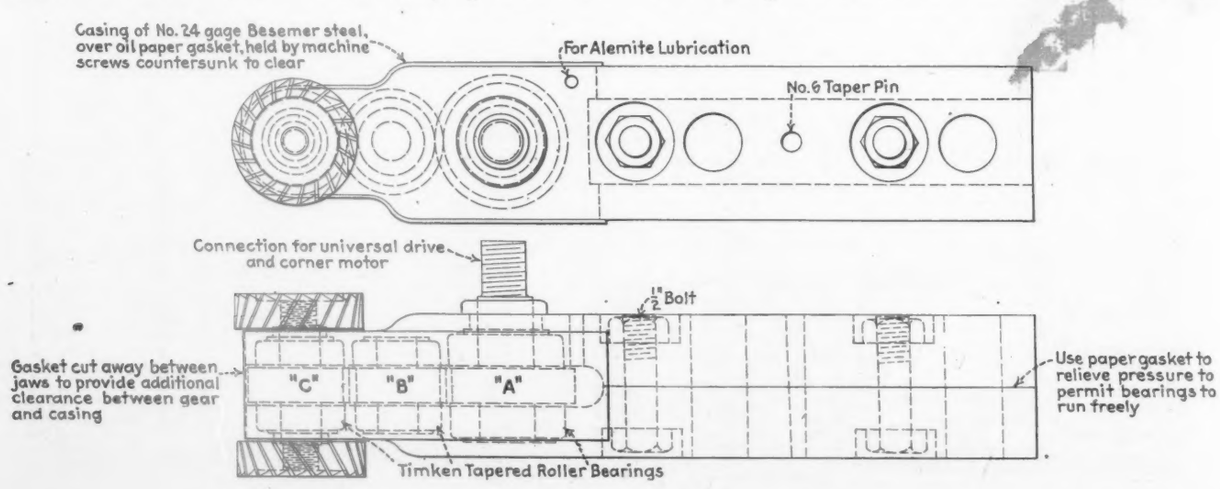


Device for lifting a lathe chuck on and off the lathe

over the admission line, the practice of squaring the ports was adopted. This practice, when running at a 25 per cent cut-off, results in an additional steam admission area of 5.81 per cent.

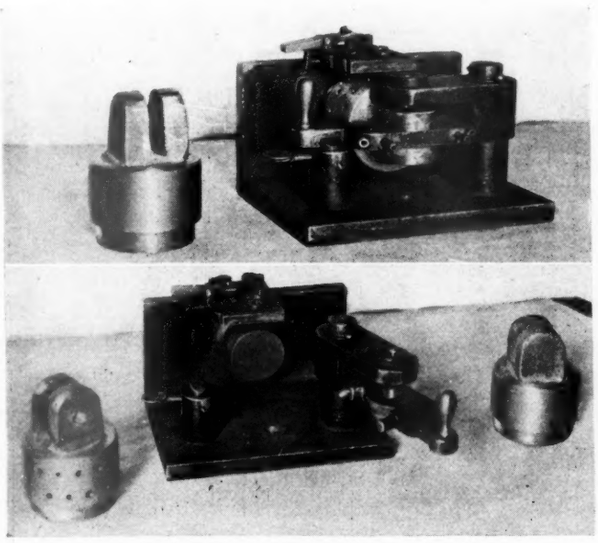
The squaring of the ports when the practice was first inaugurated was a tedious and difficult job, as it was necessary to chip and file the ports, requiring approximately two hours per bushing, four bushings being required per engine. After the development of the tool illustrated it became a quick and simple operation.

The bushings are bored to size on the boring mill and


Casing of No. 24 gage Besemer steel, over oil paper gasket, held by machine screws countersunk to clear
For Alemite Lubrication
No. 6 Taper Pin
Connection for universal drive and corner motor
1" Bolt
Gasket cut away between jaws to provide additional clearance between gear and casing
"C"
"B"
"A"
Use paper gasket to relieve pressure to permit bearings to run freely
Timken Tapered Roller Bearings

Milling tool for squaring valve-bushing ports—Union Pacific, Omaha, Neb.

the depressed area over the ports trued up. The bushing is then placed on the horizontal milling machine where the ports are milled to the admission lines using a one-inch diameter milling cutter which traverses the contour of the port opening. This operation necessarily leaves some stock in the corners of the ports, approximately .0536 sq. in. This work is performed at differ-



Jig for drilling steam-chest relief valves

ent times when the machines can be spared and a stock of bushings finished in this manner is carried on hand at all times. As bushings are required the outside fit of the bushing is made in a lathe at which time the squaring of the corners of the ports is taken care of. The setting up of the milling tool and squaring the ports requires 10 min., as against two hours by the chipping and filing method. When it is necessary to send bushing and other terminals for application, the outside fit is not made, the time required for setting up and squaring the corners being 15 min.

Valve-cage bushings are carried in two sizes, 12-in. and 14-in. diameters. The 12-in. bushings have nine equal ports 3-1/16 in. between bridges and the 14 in. bushings have 10 equal ports 3¼ in. between bridges. The tool is so constructed that only two holders are required to take care of the bushings with various widths of ports. One holder is required for ports 1⅞ in. to 2-1/16 in. wide and one holder for ports 2⅛ in. to 2-5/16 in. wide. The cutters are made in different diameters and are interchangeable. One insertion of the tool in the port squares all four corners.

The tool consists of a holder with a set of gears in the jaws mounted with Timken roller bearings which run in a grease bath and is driven through a universal shank by a corner motor mounted in a bracket. The entire assembly is set up on the tool post of the lathe. This tool has resulted in a saving in machining of valve cage bushings over the old method of approximately seven hours per engine.

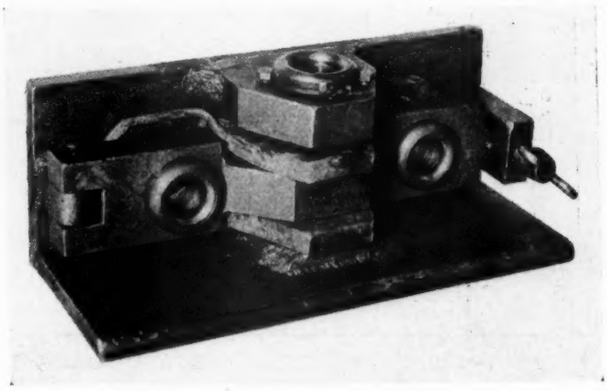
Jig for Drilling Steam-Chest Relief Valves

A jig for drilling steam chest relief valves is comprised of an angle plate 6 in. by 4½ in. by ¾ in. with a stud to fit the inside of the valve body and a swing latch which lines up the body and carries the drill bushing for the hole in the cars, which is for the bolt that carries the cam lever and a catch for the latch, also a plate on top which carries two drill bushings and a lever which operates an index pin.

To drill a relief valve body, place it on the stud and close the latch, which lines up the body and holds it in place. Drill the three holes, two of which are in the body and one in the ears; then press the thumb piece and open the latch; press down on the index lever with the left thumb and rotate the body of the valve to the left until the index pin drops into the first hole drilled; then drill two holes in the valve body; then repeat, indexing and drilling until you have drilled around the body.

Jig for Drilling Flue-Sheet Stays

A drill jig for flue-sheet stays is made up of an angle plate 6 in. by 6 in. by 15 in. by ¾ in. A square stud to act as a hinge for the arm which carries two of

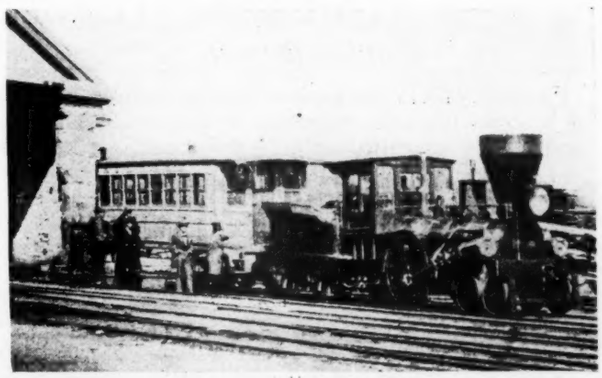


Jig for drilling flue-sheet stays

the drill bushing is welded to the angle. This arm locates and holds the flue-sheet stays in place with the aid of the lock and lug at the right. A lug is welded to the angle plate to carry the third drill bushing, for drilling through the two lugs of the stay. After drilling these holes, the jig is turned over 90 deg. to its other face and the two holes drilled which are used in riveting stays to the boiler. This saves laying off each stay and also helps in interchangeability of manufacture.

[The report was read by Chairman L. R. Denst, tool foreman, Chicago Junction Railway, Chicago. Only a few of the devices can be illustrated in this issue.—EDITOR.]

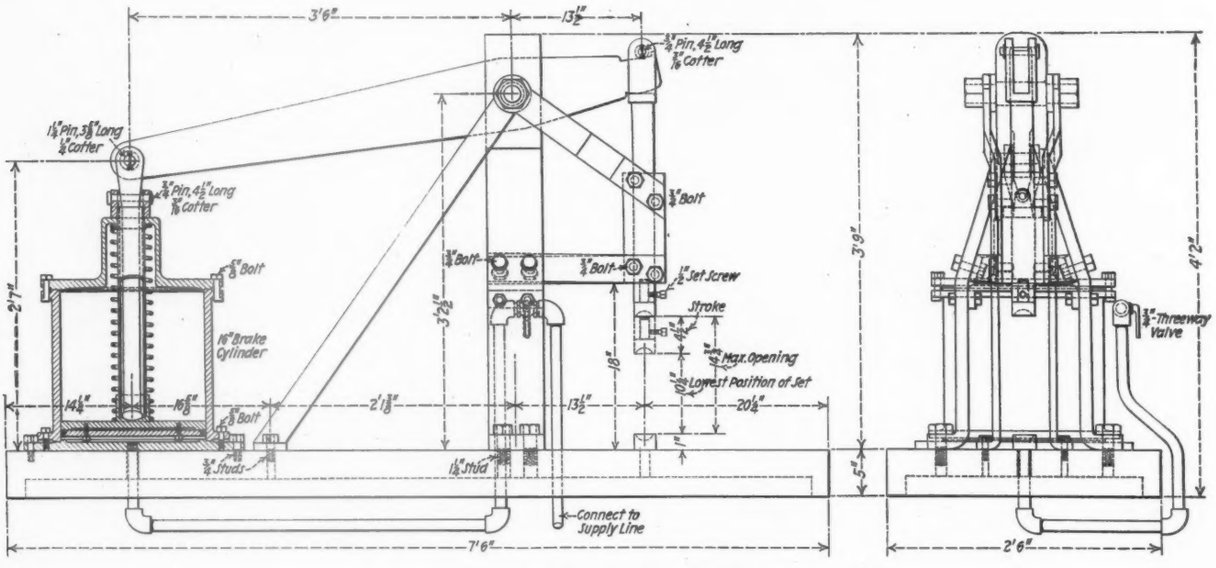
* * *



Eastern 4-2-0 type locomotive "Sagamore" built in Philadelphia in 1840 and rebuilt in 1848—This locomotive at one time carried the name "Marblehead"—Photograph taken at Salem, Mass.

Coupler-Yoke Riveting Machine

THE air operated coupler yoke riveting machine shown in the drawing, is placed on a wooden frame, 22 in. high. The pipe and fittings used on this machine are ¾ in. throughout, except where otherwise indicated. It consists essentially of a cylinder in which a standard piston for a 16-in. brake cylinder is used. The piston head and spring can also be reclaimed from ordinary 16-in. brake cylinder equipment. The design of the machine permits a stroke of 4½ in. and a maximum opening of 14¾ in. The lowest possible position of the set allows an opening of 10¼ in. The device is operated by means of a ¾ in., three-way valve, which is located in a position convenient for the operator.



Coupler yoke riveting machine

The troughs are packed with wool waste, which is saturated with flange oil for winter service and a heavy oil for summer service. The oil slowly runs out of the slit at the bottom of the trough, down the side of the guide bar into the crosshead shoe. The original guide oil cups are also used for lubrication.

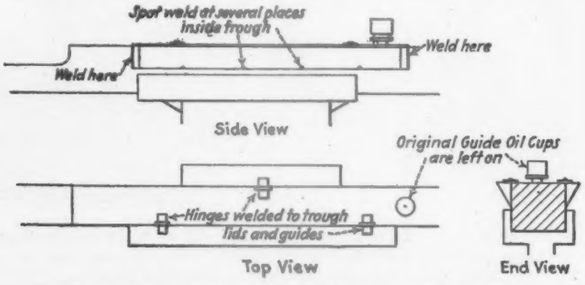
* * *

Oiling Device for Crosshead Guides

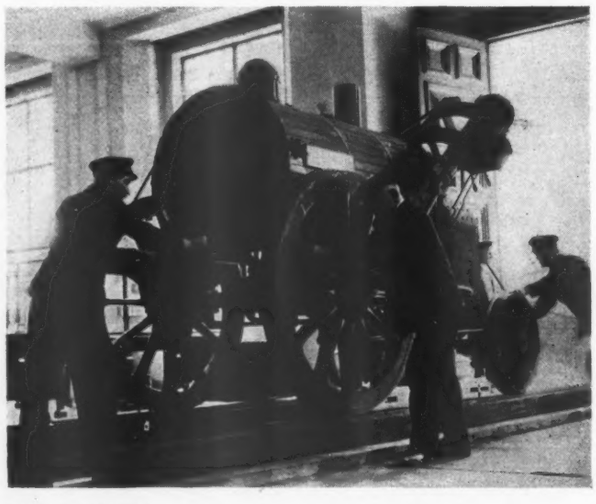
By Fred W. Voll, Jr.

RECENTLY the Denver & Rio Grande Western experienced an epidemic of hot crosshead shoes and guides on certain types of locomotives. It was discovered, after an extensive investigation, that the trouble was caused by inadequate lubrication. By applying the oiling device shown in the illustration to the crosshead guides, the trouble due to improper lubrication was eliminated.

The device consists of vee-shaped troughs made from 1/16-in. sheet metal. Each trough is about 2 in. deep, and the bottom of the vee is a short distance above the edge of the crosshead shoe. A trough is tack welded to each side of the top guide. The top is covered with a hinged lid to keep out dirt and grit.



Method of applying crosshead guide oiling device



Wide World Photo

Replica of the "Rocket" built for Henry Ford's "Museum of Work" being placed in the Science Museum, South Kensington, London, England, for exhibition prior to its shipment to the United States

Car Officers' Meeting at Chicago

First annual convention of M.C.B. & S. Association notable success —Able speakers contribute to program

THE Master Car Builders' and Supervisors' Association, formed at St. Louis, Mo., a little over a year ago by the amalgamation of two former associations, held its first annual convention at the Hotel Sherman, Chicago, September 4 to 6, inclusive. The meeting conducted by President S. O. Taylor, master car builder of the Missouri Pacific, St. Louis, Mo., was a notable success both from the point of view of attendance and of interest in the program.

The speakers included T. W. Demarest, general superintendent motive power, Pennsylvania, Western Region, Chicago; Dr. Samuel N. Stevens, professor of psychology, Northwestern University, Chicago; and C. D. Coates, electrical engineer, Chicago Pneumatic Tool Company, Cleveland, Ohio. Abstracts of these addresses will appear in this and subsequent issues of the *Railway Mechanical Engineer,* also the committee reports presented on the following subjects: "Tank Car Maintenance," "Elimination of Oil and Grease Spots," "Education of Car Inspectors," "Car Loading," "Renovation of Passenger Equipment," "Rebuilt Cars," "Wheel Shop Practices," "Reclamation," "Interchange Rules," "A. R. A. Billing," "Loading Automobiles to Prevent Floor Damage" and "Selection of Cars for Commodity Loading."

At the concluding session of the convention the following officers were unanimously elected to guide the association in its activities during the coming year: President, C. J. Wymer, superintendent car department, Chicago & Eastern Illinois, Danville, Ill.; first vice-president, K. F. Nystrom, superintendent car department, Chicago, Milwaukee, St. Paul & Pacific, Milwaukee, Wis.; second vice-president, F. A. Starr, supervisor of reclamation, Chesapeake & Ohio, Richmond, Va.; third vice-president, L. R. Christy, master car builder, Gulf Coast Lines, Houston, Tex.; fourth vice-president, E. J. Robertson, superintendent car department, Minneapolis, St. Paul & Sault Ste. Marie, Minneapolis, Minn., and secretary-treasurer, A. S. Sternberg, master car builder, Belt Railway of Chicago. The board of directors, as newly elected, consists of the following: Chairman S. O. Taylor, master car builder, Missouri Pacific, St. Louis, Mo.; F. H. Becherer, superintendent car department, Central Railroad of New Jersey, Jersey City, N. J.; R. J. Overton, general foreman car repairs, Southern, Spencer, N. C.; D. E. Bell, A. R. A. instructor, Canadian National, Winnipeg, Man., and A. J. Krueger, master car builder, New York, Chicago & St. Louis, Cleveland, Ohio.

President Taylor's Address

Since our St. Louis meeting I can safely say that the two former organizations have been welded and coordinated into one staunch association. From now on we must all put our shoulders to the wheel. Our worst period is now over.

We are in a period of rapid progress in the development of devices and designs of car equipment, and in fact this development is so rapid that standards and practices of today are obsolete tomorrow. Due to present-day keen competition between railroads, high-speed trains, diversion of business to motor coaches and freight trucks and airplanes, it is imperative that each of us continually study the other fellow's practices, both railroad and industrial. When any increased efficiency or economies can be made through labor-saving devices, introduction of high-speed tools and machinery, rearrangement of shops, better working conditions for our men, etc., we should immediately put them into effect, as it is only by increased savings that our managements can appropriate increased funds to maintain car departments as they should be.

Foremen should at all times encourage workmen to submit any ideas they have with respect to improving the efficiency in the car department. Higher supervisors should also encourage their subordinates along the same lines.

One of the most expensive things that we have on the railroads is the hot box. I think that there has been more done toward the elimination of the hot box in the past two years than ever before in the history of railroads. However, we still have a long way to go. Transferring of cars is another big subject. We have accomplished a great deal in this respect, but I am sure that we can still make further improvements in eliminating the transferring of cars. Commodity carding of cars is another subject that should be watched closely. Everything possible should be done to educate inspectors to a standard practice of carding cars.

I want to say a few words about publicity. Most railroads maintain a highly specialized publicity depart-

ment, whose duty it is to place before the public information regarding what is being accomplished. You should tell the people in this department what you are doing in the way of saving and economical operation and efficient operation of your railroad, and especially in your department. I am sure that they will be benefited by it as well as yourselves.

S. O. Taylor (Mo. Pac.) President

C. J. Wymer (C. & E. I.) First Vice-President

K. F. Nystrom (C. M. St. P. & P.) Second Vice-Pres.

F. A. Starr (C. & O.) Third Vice-President

A. S. Sternberg (Belt Ry. of Chicago) Secretary

Freight Equipment Needs

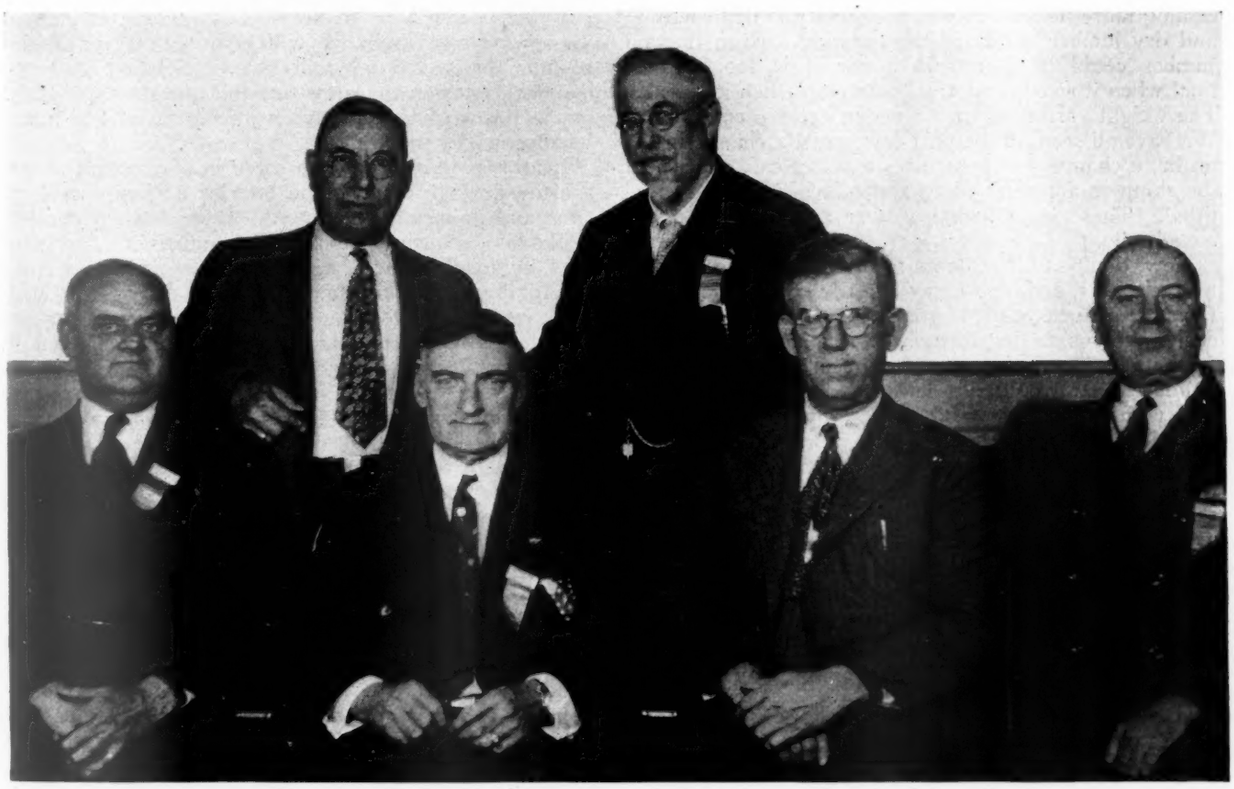
By T. W. Demarest

Superintendent Motive Power, Pennsylvania, Western Region

The more I come in contact with operating costs and net returns, the more I am convinced that nothing is worth while, neither subjects, investigations nor appliances, unless the results will produce net revenue to our stockholders. While I have been to a great extent all of my life a "locomotive man," I have had, through force of circumstances and perhaps some inclination, to pay more than a considerable amount of attention to the cars, particularly the freight cars.

I am going to talk to you this morning, therefore, on some of the developments in freight-car construction and maintenance which seem to me, if followed up consistently by all of us, cannot help but increase the service time of the car, decrease its visits to the car repair tracks, and reduce the maintenance costs per mile. Some of you, perhaps, were fortunate enough to be able to attend the last meeting of the Mechanical division, American Railroad Association, at Los Angeles, Cal. I regret you were not all able to be there. There were two outstanding developments at that meet-

ing—one, the report of the Committee on Friction Draft Gears; the other, the final adoption by the Division of the principle that, in future construction and replacements, cast-steel truck side frames will be used. The division from year to year has gradually defined construction and strength requirements, effective as yet principally to truck and underframe construction. In spite of the adoption of a minimum sectional area of center sills and the Type D coupler, owing to increased car capacities, increased length and weight of trains, increased speeds, and the natural stress under which the entire movement is taking place, we were gradually getting back, in so far as center-sill damage was concerned, to our previous situation. We had forgotten, for the time being, that there was another element in the combination that would have to progress concurrently, and that was the friction draft gear. The committee report was a most timely one and for the first time presented to all of us the relative strength and weaknesses of the various types of gears, and indicated to all of us, the railroad user as well as the manufacturer, the lines along which we shall have to work to bring this detail up to the point that, instead of the car protecting it, it will protect the car and in so doing, protect itself.



A group of officers and directors of the Master Car Builders' and Supervisors' Supply Association

Left to right—Standing: A. N. Lucas (Oxweld Railroad Service Company); F. E. Dodge (National Lead Company). Seated: J. T. Cralley (Union Metal Products Company), president; J. W. Fogg (MacLean-Fogg Lock Nut Company); Bradley Johnson (W. H. Miner, Inc.), secretary-treasurer; E. H. Hall (Milar, Clinch & Company), second vice-president.

The Cast-Steel Side Frame

The adoption of the cast-steel side frame for trucks is one of the biggest advances made by the association, and to me ranks, in what it will accomplish, with the adoption of the air brake and the automatic coupler, and while the action of the division was not entirely complete, it being permissive under certain conditions to use the older types of cast-steel frames, it is only a question of time until no side frame will be countenanced unless it conforms to A. R. A. standards at the time it is applied.

Aside from the question of increased safety, I wonder if the full significance of the action strikes you. It means decreased labor and time in inspection, in interchange, in transportation yards, and in repairs on freight-car repair tracks. You will begin to obtain these advantages from the moment you begin to apply them. It will reduce truck maintenance to wheel and axle work, and as these details must be continuously maintained, it provides, in effect, for a truck that never wears out. On freight-car replacements, it provides a truck which may continuously be reapplied to new car bodies, reducing the cost of replacement to practically that of the new body; as couplers, draft gears and the major portion of the air brake should also be recoverable. It is incomprehensible to me, with all of these advantages in sight, that the application is not generally proceeding at a more rapid rate.

The journal bearing in the truck construction and the hot box, train delays, set-off cars and maintenance expense, is still a nut to crack. The answer is fairly clear, i. e., eventually, perhaps, the roller bearing, but until the capital charge for application is materially reduced and until a common standard of axle and box installation can be adopted, its use seems prohibitive in freight service.

More Standardization Needed

And this brings us to the largest unsettled question in freight-car construction and maintenance, and that

is, the body of the car, the material of which it is made, its type of construction and the type and construction of details applied to it—side doors, roofs, and, if you so please, ends. While the Committee on Car Construction has made a notable advance and roads are gradually adopting the standard cars as they are developed, there are too many variations being placed up to the committee, based on presumed traffic differences and requirements on different roads, forgetting entirely that cars today are in universal service. There seems to be only one way to control the situation and that is for those who control the activities of the A. R. A. to put their foot down and agree on a policy which will be followed by all member roads.

There are still a great number of cars in the country with wood bodies; some of them may have steel frames and some also have steel ends. Lumber is becoming more difficult to get, the quality is depreciating, and dry lumber is out of the question. Even if good lumber could be placed in a car it is too hard to hold when it swells and cracks develop when it shrinks. The weight variations of a wooden car are continuous. We have all seen, in the past few years, a change in the traffic, a change which requires a better car, one which the shippers are demanding and to which they are entitled. There is only one answer and that is an all-metal body.

Now, don't say it costs more; don't say it costs more to maintain; and don't say its life is shorter. The facts are against you. If you do your part, with proper design, corrosion due to moisture leakage, can be kept from the concealed parts of the car. If you owned a house, you would not let it go, year in and year out, without painting, and if you would pay as much attention to steel cars—I am referring to house cars now—the bodies, barring wrecks, should last indefinitely. The current maintenance, under ordinary handling, should be reduced to floor and lining repairs, repainting, and wheel and axle work.

I am also firmly convinced that in so far as the economy of freight-car construction and maintenance are concerned, there should be no proprietary details or devices; that such items should be standardized, be the property of the A. R. A., and free to the member lines at a manufacturers profit only.

If we know how to maintain a freight car, and sometimes I think we don't, we are too slow in putting the proper methods into effect. Insofar as heavy repairs are concerned, we have made tremendous advances. We have established shops where the work is processed and comes through in the minimum time and at a minimum expense and is turned out as a new car.

Our light-repair operations are another story. We are still largely content to do the work only for which the car was shopped and not endeavor to do all of the work which should be done on the car to make it entirely fit. While this result cannot be accomplished at once, as it apparently slows up the output of the repair track, it is a situation ahead of all of us for gradual development, and whether we do much or little it should be done right and done to last.

Periodical Shopping Will Reduce Light Repairs

And, in connection with this development must come the periodical shopping of cars for reconditioning. Whether this should be on a three-year basis, more or less, I will not attempt to say, but I know the practice is bound to come and I know when it does, the various light repair tracks will be devoted to correcting shifted loads and making accident repairs. The number and condition of the cars in service will most notably improve, and the cost of freight-car maintenance will show the same notable decrease that has accrued in the cost of maintaining locomotives, based on the adoption of similar principles.

Don't get the idea in your minds that I think we will get to the place where there will be nothing for us to do. Far from it. We have some problems confronting us that are in our control and some not so readily solvable; improper methods of loading, to start with; materials which, even when loaded according to the loading rules, are most difficult to hold—creosoted poles and light sheet plates, for instance—and furthermore, our individual responsibilities in obtaining better handling in our transportation yards and on the road, to reduce not only car damage but delays to shipments and loss and damage claims. Regarding hot boxes and cut journals, I hope to see the day when, instead of an annual repacking, we will be repacking on a six-months' basis and we will not be figuring in terms of what it costs to carry out this program properly, but in terms of transportation money saved and maintenance money saved.

Features we still have to solve in maintenance costs are the damage done to the interior of house cars, to floor and lining on account of nailing blocks or other methods of securing shipments; the misuse of first class cars by loading them with materials which ruin the car for high class shipments; and the damage to open-top cars when unloading them under adverse weather conditions by building fires under them, and even in some cases, loosening up the contents with an explosive.

Don't you gentlemen think for one moment there are not live constructive matters in front of you in connection with freight car design and maintenance, in connection with solving of which you can all have a part, and as they are solved, they will result in fewer total cars, more serviceable cars, and a lessened expense to your respective roads.

Interchange Rule Revisions Disregarded

I am going to get into the interchange rules for a minute, but I am not going to say very much about them. The point that is perhaps most strongly in my mind is the fact that the American Railway Association adopts yearly changes in the interchange rules, and apparently it has gotten to be the practice at one or two of the interchange points to abrogate the changes in the rules as promptly as they come out.

I have one particular situation in mind today in connection with a rule that was incorporated in the interchange rules at the request of another association and based entirely on safety. Yet I am reliably informed that two of the largest interchange centers of the United States have abrogated the rule. I submit to you that a condition of that kind is a most inadvisable one and that it may be necessary, in order to have the interchange rules carried out, that the American Railway Association take charge of local interchange work.

I am going to scold some of you a little. The Arbitration Committee, after going through your proposed change in the rules very carefully, were a little bit at a loss, and they decided that the easiest way to handle the matter was to ask that three or four representative joint interchange inspectors meet with a joint committee from the Arbitration Committee and decide on just what some of the proposed changes meant. We found that the chief joint interchange inspectors were not a unit themselves in what they wanted and they

were not a unit in understanding in the same way the requests made of the Arbitration Committee.

I have always taken the position that the chief joint interchange inspectors could be a most helpful body to the Arbitration Committee; in reality that they ought to be a subsidiary Arbitration Committee, but if they behave that way many times more I will have to change my mind.

Why Not Clearing Houses for Repair Bills?

I am going to suggest something revolutionary. I believe that the interchange rules are a necessary evil for the time being. I hope to be able to see the day when we won't have an interchange rule, except perhaps some requirements for private cars. That happens to be the fly in the ointment.

On any of our own railroads, which are largely consolidations of smaller lines, you don't in any way attempt to inspect against each other. As your systems become larger through the consolidation of railroads you don't inspect against one another. It is conceivable that if all the railroads in the country were in one system you wouldn't inspect against one another. Why do we do so today? Is it to try to help keep one another honest, or just why do we do it? Normally you would expect a balance between bills payable and bills receivable as concerning all of the railroads. There is no such balance; the bills receivable amount to a million dollars, in round numbers, more than bills payable, which is simply an evidence that on some roads there are practically no bills payable and that all the bills were receivable. It was rather an odd condition. Based on the difference between the bills payable and the bills receivable, which in round numbers is a million dollars, the cost of collecting that difference in money is 25 per cent. In other words, it costs $250,000 to collect a million, or it would take $3,000,000 of all the railroads' money to handle the freight car repair bills. What is the use? Why can't the railroads, as between themselves, develop a plan for the elimination of all the cross-billing and all the cross-checking? If a clearing house will do the same thing when made up of a number of different railroads, why will not a number of clearing houses, as divided among the railroads in the country, produce the same effect? It will. Furthermore, it will have this most advantageous result: It won't pay a man to try to beat himself, because every bill made to the clearing house will be pro-rated among the railroads at issue on some basis, perhaps on car use, per diem or some other unit. That is a development I hope to see.

Freight-Car Maintenance Exceeds Locomotive

In closing I want to say that I am rather proud of this association. You have a good, live membership. You are in contact daily with one of the items of expense which has not been properly supervised or corrected, the maintenance of freight cars. We have all been too prone all of our lives, perhaps, and during the past five years when the railroads have made great progress, to look at only one thing, the locomotive. We forget all of the time that the number of locomotive units in the country is perhaps 50,000, as compared with 2,250,000 freight cars. The locomotives represent a much smaller percentage of the rolling stock than freight-car equipment does. We are all too prone to forget that when we come to the maintenance expenses, we are spending more money on the maintenance of the freight car than we do on the locomotive. I want to correct that statement. I meant to say the lack of maintenance rather than the maintenance. I don't see any reason, as I said before, why principles which have proved effective and economical in locomotive maintenance can't be applied to produce the same results in connection with the freight car.

It is your business within the limits of your official positions and activity and, by contact with your superior officers, it is entirely within your province and it is your responsibility, to try to develop a better condition of freight-car repairs which will naturally produce more active cars with less capital invested in the number of units to produce more cars fit for first-class lading, all of which will reduce maintenance expenses.

The Psychology of Handling Men

By Dr. Samuel N. Stevens
Professor of Psychology, Northwestern University, Evanston, Ill.

Someone has said that a psychologist is a person who knows more and more about less and less. I sometimes have the feeling that perhaps that could be a description of almost anyone who is trying to discover ways and means of increasing his personal effectiveness in the life that he has to live. Particularly would it be true of men, and women too for that matter, who were trying to find more and more effective ways of handling this very complex and subtle and interesting thing that we call human nature.

I have always insisted that for anyone to lay claim to even the right to supervise, handle and control other human beings he must first have learned to control himself. That is a kind of bromide, I know, and yet is one of the truest things that I have ever discovered. Let me give you an illustration of how a failure at this point results in a failure in larger things.

In a certain factory here in Chicago they had been having a good deal of trouble with a group of men doing a type of what we might call light-heavy work. In other words, they were not skilled mechanics, but they were men who were doing semi-skilled work of a fairly heavy character. There were about 120 men in the group, and the company felt that this section of their industrial life was not maintaining itself and its level of efficiency in comparison with the rest of the industry. They asked me to come in and see if I could discover what was the matter. They had been unable to do that on their own account.

After having made a careful survey of conditions and having tested a large number of men to discover the relative ratio of efficiency, so far as their placement in those jobs were concerned, I began to look into the more personal aspects of the situation by interviewing the supervisors and the foremen and assistant foremen within the group. Very much to my surprise I discovered that the seat of the difficulty was to be found in the fact that there was not a proper rapport between the foremen and the assistant foremen, and as a result of the conflict between these two groups of men the entire process of the industry, so far as that section was concerned, was handicapped.

What was the matter? Simply this: Two assistant foremen, very ambitious, very willing to work, very eager in fact, to make good, were jeopardizing, because of their efforts, the efficiency, the standing, the rating of one of the major foremen, with the result that out of

fear for his own job, he was continuously effecting changes in the gangs with which these men had to work, and by indirect methods, negating his power to lead the men, with the result that the efficiency was reduced almost fifty per cent over any given week of work.

Dismissal an Admission of Failure

Here was something that was a personality problem. Of course, it would have been very simple for me to have recommended to the general manager, "Get rid of this man," or "Get rid of those two men. Get somebody else in their place and everything will be fine." That is always a very easy thing to do. If you can't get along with a man, fire him. It is simple. But it is a recognition, it seems to me, of failure. Consequently, my problem was to effect, if possible, an understanding between this foreman and these two men with whom he was having difficulty. After a few conferences with them it wasn't so hard for the foreman to see that by taking a different attitude with regard to the ambition of these two younger men, by giving them, if you please, a little more authority than they had, he would be stronger because of their larger loyalty to him.

There is a preliminary principle in the handling of men that seems to me to be worth your while as you consider it. Only a small-minded and basically inferior individual need ever be afraid of the good work that someone slightly lower in the scale of jobs will do. Yet I find in my work in industry and factories of one kind and another that here is one of the greatest causes for difficulty between supervisors, foremen and the like. It is a fear on the part of men higher up that men who are responsible to them will show them up or make them appear less effective than they ought to be.

The second illustration of this principle came to my attention not long ago in working with an automobile company. Science has succeeded in mechanizing our industrial life to such an extent that I sometimes fear that the invidual values are being lost sight of. Yet it seems to me that, with all of our mechanical ingenuity and engineering perfection which characterizes all industry at the present time, the greatest value still remains to be obtained from the change in perspective on the part of those responsible for leadership in industry from the gang worker to the individual worker. After all, 100 men may constitute a gang, but they are 100 individuals, and the foreman or the supervisor or the manager who expects to get the most out of that gang can do so by getting the most out of each individual in the gang. Each one of these men is different; each one has ambitions of a sort; each one has needs of a sort; each one has troubles that are peculiar to him; each has anxieties that are peculiar to him; each has physical and mental disabilities at one time or another that are peculiar to him.

Our attempt to treat workers enmasse is one of the weaknesses of our system. Even as we have produced perfection in our engineering procedures, producing wonderfully intricate and delicate machines, so we have to recognize that a human being, while not a machine, while not susceptible to the same mechanical principles that a machine is, is an individual delicately adjusted, easily thrown out of balance. The failure of one man or two men can so reduce the efficiency of a group of men that there would be hardly any comparison between the amount of work that they would do when all the values were maintained in each individual case and when some of the values were lost because of the failure on the part of supervisors and managers and foremen to recognize this individual principle. I shall illustrate how that works.

Individual Characteristics Must Be Studied

In an automobile company they had been taking almost everyone who came because of the wide varieties of jobs they had. On the assembly line it is only necessary for a man to make a very minor movement of the rachet, or a brace and bit, or a monkey wrench or whatnot, and his job is finished. So every man who had two hands and a pretty good pair of eyes, though not a skilled mechanic, could do the type of light work required on the assembly line. The fact of the matter was that there were a lot of mistakes occurring. When an engine, for instance, in the process of being assembled, got to the end of the line, sometimes it was necessary, too often it was necessary to send that engine to a special assembly table for improvement and reconstruction. Likewise, in the rush of the work it became necessary to slight one or two little movements, which, while they didn't show, made all the difference in the world between a good product and a poor one. I was called in to see what could be done to take care of this difficulty. Here is what I found.

They had been hiring men without reference to their relative height, the relative lengths of their arms, their relative abilities. They were putting a six-foot six-inch man next to a five-foot six-inch man on the assembly line and expecting the shorter man with the shorter arm reach to do in exactly the same time the same quality of work that the bigger man with the longer arm reach could do, with the result that every once in a while there would be a failure for a complete adjustment to be made. That failure, accumulating, as you can see, as the assembled product gathered more and more of concrete form as it approached the end of the line, made things much more difficult. After a study of about a week, it was possible to make recommended changes which cost the company $25,000. They were much worried about making an expenditure of that much money for adjustments. It involved the rearranging of men as individuals, so that a man who was six feet six inches was working next to a man who was six feet six inches and with practically the same arm reach. The result was that the efficiency of the total operation increased 26 per cent. The number of engines and body frames that had to be reconstructed and gone over again was reduced by 62 per cent, and the general happiness and satisfaction of the workers was perhaps increased 200 or 300 per cent. I couldn't measure that.

Levels of Ability Vary Widely

The third principle that we have to remember is this: The levels of ability that are the natural, native levels of ability are just as varied as individuals are varied. In work where you have skill playing a real part the individual differences, so far as native abilities are concerned (in other words, intelligence), become a factor in determining the efficiency of the individuals. One of the causes of labor turnover in types of industry wherever the work, while it does not involve a great deal of skill, is monotonous, is that men are picked sometimes for those jobs who are too intelligent for that work. They soon become annoyed and fatigued and disgusted and they quit their jobs. The foreman will say, "That fellow had a lot of ability. The trouble is he had too much."

Industries that do not take into account those possible individual differences of native endowment are bound, sooner or later, to lose a great number of very effective men because they do not give them the enlarged opportunity that is a part of their natural birth-

right on the basis of their intellectual and natural ability. That may sound a little strange to you on account of the next statement: I believe that, everything else being equal (which it very seldom is, of course), men have a tendency to reach a kind of level where their natural ability has its most adequate expression.

Efficiency Impossible Without Satisfaction

From the point of view of the satisfaction of the individual, industry still has to learn a great deal, in my opinion. Efficiency cannot be called efficiency, no matter how much good work it produces, if it does not produce satisfaction to the worker. Any man or any group of men that you have under you who goes home at the end of the day, dissatisfied, disgruntled, unhappy, excessively fatigued, is not being treated right, to that extent industry is failing to meet its moral and its economic obligations to the worker.

When I was in Europe last year I had occasion to talk with a man who was the personnel director and general technopsychologist for a great industry in Germany. I said to him, "What is your ideal for your people?" He said: "To send every worker away from these factories when the whistle blows at night, happy, contented, and with enough energy left to do something creative for himself beyond the demands that the economic life he lives makes on him."

I went into France and talked with a man there. I said to him: "What is your ideal for your workers?"

He said: "To see to it that they approximate 100 per cent efficiency in proportion to the level of their ability for the length of time that they work in the factory." That was his ideal for his people. In other words, he saw to it that they worked with 100 per cent efficiency, if possible, while they worked in the factory. "Any other ideal would be disloyal to my company," he said.

I said: "Tell me, how do you get this result?"

He replied: "By seeing to it that no individual works beyond an optimum level of speed and an optimum level of energy output throughout the course of time that he is working in the factory?" In other words, the load of work that the individual was to perform would be proportionate to that individual's capacity, not in proportion to that particular job and not in proportion to the technical requirement of the machine itself. The man was fitted to the machine and not the machine running irrespective of the individual's energy output in his own right.

Suppose we were to be a little more thoughtful of the fact that every man who comes to work for us brings his environment in a very real sense with him. He doesn't shed his home and family anxieties and all that like a coat when he comes to work in the factory. He can't do it because he is more than just so much machinery; he is more than just so many muscles to do the bidding of the gods of industry. He is a whole being, his mind and his soul and his ambitions and needs all being with him; they all come with him and he can't divorce them. They have a tendency to direct his hand no matter how skilled that hand is. When anxiety presses down on him it has a tendency to decrease his efficiency, to lower his energy output. When activities at home have somehow or other built him up and thrilled him, he has a tendency to have more energy to give out. In other words, he brings his environment, all that is involved of it, to his work. He can't help it. You gentlemen who have to control him during the day, who have to see that he maintains his major efficiency, will be very fortunate if, in the course of your contact man to man, you have the ability to offset by some word or deed or guidance of some kind or other, the negative effects of anxiety of one kind or another that harass that man as he works during the day.

Distractions Cause Accidents

In a certain factory here in Chicago that makes steel products it was discovered that accidents were occurring during the course of the day. I happened to make this survey myself over a period of about three weeks. It was found that of the accidents occurring during the day 28 per cent were caused on account of the individual being distracted while he was doing his work, and that the distractions were of the nature of home, economic, social and emotional difficulties. What does that mean? It simply means that the cost to industry over a period of years runs up into the millions of dollars because this particular failure on the part of the individual worker is not taken care of.

I have the feeling that the more intensively we understand this balancing of human nature with which we have to deal, the more intensively we will try to study the wellsprings and the mainsprings of human action, seeking to understand as carefully as we can the fact that human life is a kind of teeter-totter. Individuals living human lives are on this teeter-totter. On some days it is in pretty good balance and will perhaps return to us 100 per cent in normal efficiency. On some days the teeter-totter goes down and on other days it goes up. Our problem is to make use of the maximum efficiency which the individual has at any given time.

I hope that I haven't bored you too much by insisting on this satisfaction that the worker should get from his work due to this personal relationship between the supervisor and the workers, between the assistant foreman and the foreman and the men who are carrying out the job. I have the feeling that this satisfaction of the worker, if it can be met, will not be met alone by increasing incentives.

Shop incentives are good, campaigns and competitions are desirable, as long as they are fostered for the individual's welfare as well as the company's welfare. But remember that whenever we have to carry on a task it demands a certain energy output. That goes on continuously. If our energy, our potential energy generated on that particular day is not at that level, equal to the output requirements, we are going to be neglectful, and no amount of incentive will do any good at all.

The Board of Industrial Fatigue in London has been carrying on a great many amazing researches on fatigue problems of British workers. It has made this rather interesting discovery: It doesn't do much good to have a rest period of a certain standard length for all different types of industries, but it does a lot of good if, after an analysis, people who are doing light, or heavy work for that matter, could have a corresponding interval of relaxation following each interval of effort.

Objective Incentives Not Alone Sufficient

Each one of us in proportion should get a thrill out of the kind of job we are doing. If we are not, then somehow or other either the job doesn't fit us, we haven't the right attitude toward the job, or we haven't analyzed and made use of our basic capacities with regard to what that job requires. There we have three of the difficulties that may arise. The men over whom you have control, in whose hands your reputation rests in a real sense, who depend upon you for certain personal and, in a sense, economic satisfactions, also need to have the feeling that they are doing the thing not only in the best way that it could be done but that it is the best thing that they could be doing. Unless the job can produce those satisfactions, the efficiency of the

worker is to a large extent never completely realized. I believe that objective incentives, valuable as they are, cannot take the place of the personal satisfaction which is produced by direct company appreciation as expressed through the immediate superiors who are in more direct contact with the workmen themselves.

How many of you men can call in one of the men under you, censure him and make him like it so that he will go away anxious to work harder instead of being hurt? How many men can, without any loss of power on their own part, tell a man, "That is fine, you are doing a fine piece of work," and send him away to a bigger job and you yourselves feel greater because of it? That is the test of leadership, the place where our industrial life is weak because we have lost that personal contact and that personal control over men.

If there were one thing I should like to say in conclusion, it is this: In industry, no matter how perfect engineering principles may be, no matter how perfect the machines may be, no matter how perfect the potential energy output supply, and production may be, our objectives will not be achieved as I see it, until the individual is brought back to his place in the problem, even in spite of the tendency towards mass production.

High Frequency Car Shop Tools

By C. B. Coates

Electrical Engineer, Chicago Pneumatic Tool Company, Cleveland, Ohio

The application of the term "high-frequency" to portable tools and equipment is, no doubt, a misnomer in view of the extremely high radio and other frequencies generally understood to come within the scope of this term. As a matter of fact, the frequency now generally employed in so-called high-frequency portable tools is only three times the usual commercial frequency of 60 cycles per second. However, as the name has come to be quite generally accepted as applied to this class of tools it is used here.

Older Types of Tools

Electric drills of the portable type were introduced over 25 years ago and were wound for operation on direct current, to conform to the prevailing conditions in the industrial plants at that time. These tools were generally series wound, but several years later the larger sizes were compound-wound to give better speed regulation, which means higher armature speed at full load, limited free speed and consequently greater brake horsepower.

A few years after the introduction of the d.c. drill, a.c. drills were developed. These were built to operate at 60 cycles and other prevailing frequencies, such as 40 and 25 cycles. They, of course, had good speed regulation, but the weight, due to lower rotor speeds, being limited to 3,600 r.p.m. at 60 cycles and correspondingly less for the lower frequencies, was somewhat of a drawback.

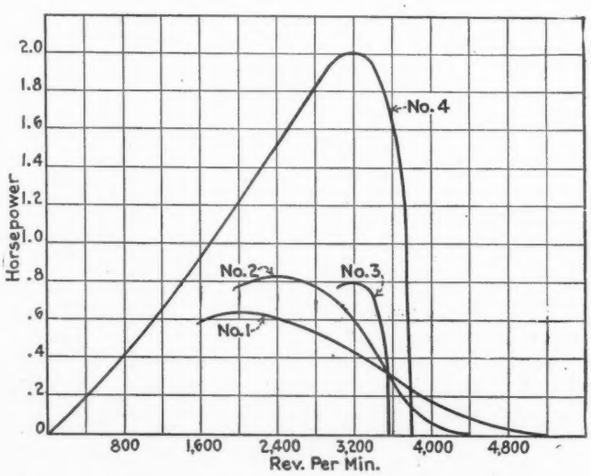
About 1908 the now well-known universal drill was introduced and has met with great favor on account of its ability to operate interchangeably at practically the same speeds on either direct or single-phase alternating current of a given voltage. The universal tool is series wound, with the typical series motor speed regulation, however.

While the falling off in speed under load was considered to be of advantage in some classes of work, it has now been demonstrated that the sustained speed, as of the induction motor, is generally preferable, due to the accomplishment of a greater amount of work. This is particularly true of portable grinders as will be shown later.

It is quite obvious that the polyphase induction-motor tool has distinct advantages over the direct current and universal tools both as regards speed regulation and lower maintenance cost, due to the absence of commutator and brushes as well as the insulated armature winding. One factor which has retarded its adoption, however, has been its greater weight due to the low rotor speed on commercial circuits of 60 cycles or less. All electric tools (d.c. universal and polyphase a.c.) have always had the handicap of weight as compared with pneumatic tools, except at the sacrifice of sturdiness. Nevertheless, many users have put up with the greater weight of the electric tool, on account of the more convenient source of power supply.

High-Frequency Tools

Several factors governed the selection of a standard frequency for these tools. Since it was necessary to obtain spindle speeds for the drills, reamers and abrasive wheels which would conform to the modern cutting tools, there must be a point where the reduction in weight of the motor due to higher frequencies would be more than offset by the greater weight of the gearing required to obtain the necessary spindle speeds. From this point of view, the desirable frequency was found to be in the neighborhood of 180 cycles per second. Troubles in ball bearings and difficulty of lubrication at high speed are another limiting factor, although improvement in both directions indicates the possibility of still higher frequencies.



Comparison of electric grinders of four different types
Curve 1: Geared universal-motor grinder—Curve 2: Geared compound-wound direct-current grinder—Curve 3: Gearless 60-cycle induction-motor grinder—Curve 4: Geared high-frequency grinder.

Thus the high-frequency tools meet the requirements of intensified production in modern industry where portable tools are crowded to the utmost and in many cases get very little care. The outstanding advantages of this application are:

1—Greatly increased power for the same weight, due to the higher loaded speeds of the rotor.
2—Reduced weight for a given power output.
3—Practically constant speed at all loads (8 per cent to 10 per cent slip) which results in the accomplishment of more work.

4—Greatly reduced maintenance cost.

Perhaps one of the most outstanding examples of the advantages of high-frequency tools is to be found in the portable grinder and buffer. Here the great advantage of sustained speed is very pronounced. The cutting wheel can be operated at the proper and most efficient speed without having to allow a high and dangerous free speed, as is the case with other types of electric and some air grinders. In addition to obtaining the most efficient cutting speeds for the wheels, the wheels themselves give practically double the life at the sustained speeds.

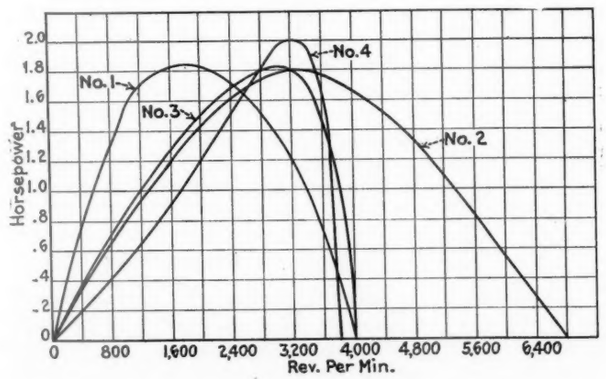
One of the charts shows the curves of four types of electric grinders, each having the same weight. The spindle or arbor revolutions per minute are shown as the abscissas plotted against the horsepower.

Curve No. 1 is of a geared grinder with universal motor and the armature running about three times as fast as the spindle. Note the extremely high no-load speed of 5,200 r.p.m., and the speed of 2,000 r.p.m. at maximum horsepower.

Curve No. 2 is of geared compound-wound, d.c. grinder. The effect of the shunt winding is made apparent in the reduced no-load speed. We also have a greater wheel speed at maximum horsepower.

Curve No. 3 is of a two-pole, 60-cycle induction motor grinder without gearing. The synchronous speed is 3,600 r.p.m. Here we have good speed regulation, and the absence of gearing is, of course, an advantage in that it permits of a large motor for the same total weight of the tool.

Curve No. 4 is of a high-frequency grinder geared



Comparison of pneumatic grinders with high-frequency electric grinder

Curve 1: Reciprocating pneumatic grinder—Curve 2: Rotary pneumatic grinder—Curve 3: Rotary pneumatic grinder with governor—Curve 4: Geared high-frequency electric grinder.

slightly less than three to one so that the free speed is about 3,800 r.p.m. This has good speed regulation and very much more power due to the high rotor speed at full load. This is the only grinder of the group that will successfully carry a 6-in. abrasive wheel at proper speed and with sufficient power behind it. The rubber-bonded wheels which permit of a peripheral speed of 10,000 ft. per min. require a smaller gear ratio, thus increasing the arbor speed, or a larger diameter of wheel may be used with the same ratio.

A comparison of the high-frequency grinder with three types of pneumatic grinders is shown in the other chart.

Curve No. 1 is of a reciprocating-piston type of pneumatic grinder. Note the range of maximum power is from 1,400 to 2,200 r.p.m., while the no-load speed is 4,000.

Curve No. 2 is of a rotary pneumatic grinder. The load speed is 3,000 to 3,600 r.p.m., which is an improvement over No. 1, but the no-load speed is 6,800 r.p.m., which is excessive for a 6-in. wheel.

Curve No. 3 is of a rotary pneumatic grinder provided with a throttling governor. Here the no-load speed is held down by throttling the air, not only making a safer tool, but consuming less air at the lighter loads.

Curve No. 4 is of the same high-frequency grinder as was shown in the first chart mentioned. The speed is held within close limits and there is plenty of power to handle the work. Furthermore, although not shown, the power consumption, as of all electric motors, is less at the lighter loads, while the converse is true of the pneumatic tools except in the case of the grinder in Curve No. 3.

Just as sustained correct speed makes for longer wear of grinding wheels and abrasive discs, so does it also give long life to reamers and drills. In reaming through a considerable thickness of steel when much metal is to be removed, a tool having great speed variation is apt to produce clogging of the reamer at extremely slow speeds and burning when the load is lessened with the reamer still in the hole.

A very striking example of the effect of nearly constant speed in increasing the life of the reamer was observed in a bridge fabricating plant with a 50-lb. high-frequency tool having a synchronous speed of 30 r.p.m. The holes were punched 11/16 in. and reamed to 15/16 in. through assembled plates varying in group thickness from 1¼ in. to 3¾ in. Over 3,000 linear inches of this reaming was done with one reamer without re-ginding. This was at a reaming rate of 3.7 in. per min., including the time of changing from hole to hole.

As an example of reaming 15/16 in. full-punched holes in deck plates on ship work, a high-frequency reamer of 300 r.p.m. synchronous speed reamed 100 holes in 9 min., which was 39 per cent faster than with a compound-wound d.c. reamer weighing 40 per cent more.

In the drilling of metal it has been found that high-frequency drills selected as to proper speed for the size and nature of the holes to be drilled will do the work in one-half the time required by the d.c. or universal drills with their greater speed variation.

In the case of grinding of steel bars it was found that the high-frequency grinder removed 12½ per cent more metal over a period of several days as compared with equal weight pneumatic grinders of the piston type. The d.c. and universal grinders, as shown by the curves, are not competitive with the high-frequency type.

So much more work can be accomplished with the high-frequency tool that large numbers of the older types of tools are being discarded. Manufacturers are recognizing the rapidly changing conditions and are willing to scrap the earlier tools to invest in the new equipment necessary, in the shape of frequency converters or motor-generator sets and new wiring, in order to gain the advantages of the increased production. The cost of power is somewhat more due to the transformation to the high-frequency current, but the individual efficiency of the tools is higher than in the old types of tools. As the cost of current in many industries is only about one-twentieth of the cost of production labor, the great increase in productive capacity made possible by the high-frequency tool com-

pensates many times for the slight increase in cost of current.

Supplying the High-Frequency Energy

There are two well-known methods of transforming commercial current to high-frequency current; viz., the frequency converter and the motor-generator.

The frequency converter can be used only when the primary current is alternating. As generally employed for operating high-frequency tools it consists of special windings in a slip-ring motor frame, the rotor of which is driven backwards, usually by an induction or synchronous motor. In operating high-frequency tools it has been customary, with a 60-cycle source of supply, to employ an eight-pole frequency converter driven at 1,800 r.p.m. to furnish 180 cycles. The stator winding is excited with 60-cycle energy and the supply line for the tools is connected to the slip-rings. The field produced in the stator winding rotates in one direction at 900 r.p.m. The rotor is turned in the opposite direction at 1,800 r.p.m., giving a net speed of 2,700 r.p.m. which gives 180 cycles per second in the eight-pole rotor. As satisfactory tool operation depends on good voltage regulation, it has been the aim of the Chicago Pneumatic Tool Company to hold within eight per cent voltage variation in the frequency converter, the full-load voltage being 220. The frequency converter has an inherent regulation and the voltage at a given load varies only with the primary voltage.

The motor-generator or alternator provides an entirely new current and at 1,800 r.p.m. a 12-pole generator will be required to produce 180 cycles. The motor can be operated from either d.c. or a.c. If the latter, an exciter will be required for the generator fields. A regulation not to exceed eight per cent is also desired with this set, but it is possible to vary the voltage either manually or automatically by changing the field current of the generator.

Each type has its advantages and, while the simplicity of the frequency converter appeals to many, the possibility of voltage regulation seems to warrant the additional cost of the motor-generator set.

The current used for high-frequency tools is three-phase and a cable with four conductors is provided with the tool, terminating in a suitable plug. The fourth conductor is grounded to the housing of the tool and the receptacle in the power line is grounded.

Maintenance of Tank Cars

In the older days when tank cars were started in private company service, the private companies, knowing the railroads were equipped to repair freight cars, relied upon them to keep their tank cars in repair. This worked very nicely when the cars were new but after a few years with repairs being made only as they became bad, the cars depreciated fast and before long, the repair charges made by the railroads were almost equal to all the mileage the cars were earning, at the same time the cars were being transferred on account of leaking and being delayed to such an extent that it required many more cars to handle the shipments than it would have required had the cars been kept up in good condition all the time.

With this in view, the majority of tank-car owners went into this subject thoroughly and started their own repair points, equipping them to recondition the cars in every respect. The results of this are that the majority of larger tank car operators, at this time, maintain shops in which they can make any repair necessary on a car. Other companies maintain sufficient forces and facilities to make the general running repairs and have arrangements with tank car repair companies to handle the larger jobs for them. In this way the general condition of tank car equipment today is in one hundred per cent better condition than it was ten years ago.

Companies owning tank cars try to have just enough cars to take care of their shipments and not have a large supply of empty cars lying around idle; therefore, it is necessary that cars get through to destination and return in the best possible time. To do this the cars are given the closest inspection and repair that can be given to them.

Another thing which makes it necessary that cars be in condition to move through without delay is that when selling tank car shipments of petroleum products, a delivery date is always set and unless the car reaches destination by that date, we are confronted with a cancellation of the order, which means considerable trouble and reconsigning charges, and on many occasions reduction in price to find a buyer; all of this is expense which we feel can be eliminated by giving the cars the proper attention.

The handling of tank cars differs considerably from ordinary freight cars in that freight cars are built and sent out and in many instances do not return to their home road for years, while with tank cars, it is very seldom that they go over 60 days without returning to their home plant. Therefore, the ordinary freight car has to be repaired continually by the railroads, while small defects on tank cars, other than penalty defects, could be allowed to run until cars reach home, where they would be repaired by owners and in this way expedite the movement of cars, as well as cut down repair costs on the railroad. Careful study of repairs made to tank cars by the railroads shows that various railroads seem to specialize in one kind of repairs, these being different on different roads and we believe this specializing on one kind of a repair makes the men a little closer on their inspection of these parts than is really necessary for the prompt and safe handling of equipment.

Tank Cars Repaired Periodically

The majority of tank car owners have certain periods at which they recondition their equipment and when a tank car has gone through this reconditioning, it is almost as good as new. Some companies recondition every two years while others figure every three or four years. This is a very important thing if cars are to be continued in service and expected to keep moving.

This reconditioning generally means the tightening and replacing of worn material on trucks; the replacing of broken castings; the adjusting and replacing of draft gears; tightening of tank anchors; renewal and tightening of safety appliances and running boards; caulking and testing of tank if necessary; bringing air brakes and hand brakes up to first-class working condition; and the repainting of the entire piece of equipment; as well as the maintenance of journal boxes. Once a car is reconditioned, the defects developing while it is enroute will be very few and far between, and it is then easier to put them in condition as they are set in for loading.

The repairing of tanks of tank cars is work that cannot be done by other than men experienced in this kind of work and it is the repairing of tanks by men who do not understand the work that is causing the tank car owners most of their grief and delay. It is possible to take a tank that is badly bent even if the bends are

sharp, and straighten it so one could never tell it had been bent but to do this, one familiar with this work must get the tank before anyone else has worked on it. We find many cases where inexperienced men have tried to straighten sheets, leaving them full of hammer marks and short kinks which it is impossible ever to iron out. Tanks prepared in this way are not only an eyesore but they tend to destroy the resale value of that car.

When a car is received home in this condition it always means considerable correspondence and delay, which is anywhere from one to four months. In the end the railroad pays more to do this work over than they would have paid to have done it right the first time. Would it not be better for all concerned in the case of a car with tank damage to give the owners protection on it and allow them to repair the tank themselves or have it repaired in a workmanlike manner. This method of handling would not cost the responsible party any more than the present method of handling and without a doubt, would reduce delay to equipment as well as keep all interested parties satisfied.

The majority of tank car owners take pride in their equipment and in view of this they have organized repair forces at all their loading points, who have nothing to do but put the cars in good condition, and they spend thousands of dollars on their equipment each year in addition to what they pay the railroads for repairs made while cars are enroute.

Tank Car Owners Anticipating New A.R.A. Rules

A check of the various tank car companies shows that the majority of them are doing everything possible to comply with A. R. A. rules and in many instances, we found them already working out, on their own equipment, tentative A. R. A. rules such as applying badge plates on their cars to show the proper brake levers and rods to be used on same to keep them up to standard and we feel if railroads, when making repairs to brake rigging on tank cars on which these plates are found, will follow the dimensions as shown on badge plates, it would materially help to keep cars moving and at the same time, make them completely safe for handling in hump yards.

We find in many instances cars are damaged and sent home to us without notification, which method of handling always means considerable correspondence and delay. Therefore, repairs will be speeded up if the company damaging a car asks for its disposition.

In an editorial entitled "Traffic and Car Repairs" in a recent issue, the Railway Age states that it has been advised from several sources that certain tank-car companies are using their control of oil traffic to get improper concessions regarding the repair of tank cars. This article goes so far as to say that the tank car operators are requesting tank cars to be moved in dangerous condition sooner than have the railroads repair them. The committee feels that this article has done an injustice to the tank car companies as well as the railroads. We feel certain that none of the larger tank-car operators have asked railroads to move cars that were not in condition to move safely to and from destination and if there might have been some smaller company made this request, the majority of tank car operators should not be criticized when they are endeavoring to do what is right.

The report was signed by Chairman C. H. McBurney, master car builder, Transcontinental Oil Company, Tulsa, Okla.; W. W. Grubbs, master car builder, Barnsdall Refineries, Inc.; and F. W. McGrath, superintendent car department, Skelly Oil Company.

Discussion

T. J. O'Donnell (chief interchange inspector, Niagara Frontier Car Inspection Association, Buffalo, N. Y.): Mr. McBurney brings out that when a car is received home with kinks in the tank it always means considerable correspondence and delay to secure protection. In our district with the tank car companies we interchange about 1,500 cars every twenty-four hours. On some of those cars we will find little kinks in the ends or on the sides of the shell, probably from two and one-half to four feet long, with a slight indent about three in. wide. Is that due to shrinkage of the metal? We don't give protection.

Mr. McBurney: When that first occurs, if it occurs in unfair usage, the tank having been thrown on the underframe, you will be able to determine that. We ask for protection on that basis. If we do the repairs and paint the car over it is an owner's defect.

Mr. O'Donnell: You will agree, then, that shrinkage will bring about some of that?

Mr. McBurney: No. I don't think shrinkage will do anything of the kind.

Mr. O'Donnell: Why do you waive protection then? I should like to ask Mr. Trapnell if he gives cards for any such defects. I am referring to the dents in the ends or the sides of the shell of the tank that you can't just tell how it happened. Do you give the car owner protection under Rule 32?

Mr. Trapnell: If the damage is sufficient to be repaired, or if there is evidence that the dent in the end or the side of the tank was put in through unfair usage, yes.

Mr. McBurney: If someone has let that tank go through without making the repairs and if it is a new defect we give protection. If there is evidence that it is an old defect, we don't give protection. It would be impossible to put a kink in a tank through shrinkage.

Mr. O'Donnell: We have them. Speaking on the center channels, we don't give any cards in our district for damage to channels between the bolsters and ends. At present we don't have any trouble with the tank-car owners in that respect, and it is very encouraging to hear a gentleman of Mr. McBurney's standing bring out that they are fair enough to take such defects home. If we got that cooperation all over the country we wouldn't be taking up these tank cars.

L. C. Fitzgerald (general A. R. A. inspector, Erie, Hornell, N. Y.): On the strength of the remarks made to the effect that our friend here doesn't ask for protection and considering the fact that at the Niagara Frontier they disregard those conditions, it results in a great deal of trouble when this equipment does move home to companies over which our friend here has no jurisdiction. The fact of the matter is, the A. R. A. rules are decidedly clear to the effect that damage existing to those center sills should be noted and the car owner is technically entitled to a statement showing how the damage occurred. When you waive his right in your district and move that car through your district into the St. Louis gateway, that's where the trouble begins.

W. J. McClennan (general car inspector, New York Central, New York): The title of the report is "Report of Committee on Proper Maintenance of Tank Car Equipment and its Effect on Increasing Car Mileage." I should like now to set forth a few points that I think are apropos to the particular title of the A.R.A. committee's report.

There are tank cars in the United States equipped with friction draft gears, which have not been removed from the cars, to say nothing to having been recon-

ditioned, in anywhere from 6 to 14 years. The result is that the coupler horn is hitting the striking casting. The striking castings are either bent or broken. If the tank car people are interested in properly maintaining their cars so as to increase the mileage (and I understand that some of the larger companies are getting as many as fifty-five miles per car per day on the average), they would be interested in spending money constructively in doing work of such a character as to bring about that mileage, even though it means temporarily a financial outlay. The rule on some large railroads is that whenever the slack in any friction draft gear is ½ in. or more, the gears of the owner's cars should be dropped and the necessary repairs made. Those repairs, as a rule, result in the gears being returned to the manufacturer for proper and economical reconditioning. That is one way to keep the cars off the repair tracks of the carriers and thereby increase the mileage per day.

Another point that I should like to call to the attention of the tank car people is this aspect of truck sides. If they are not spending money for truck sides meeting or exceeding the A. R. A. specifications and are continuing to perpetuate arch-bar trucks, especially the arch-bars of the smaller design, and waiting for them to break down, then it seems to me that they are not giving appropriate repairs which would tend to increase car mileage.

The only other point that I wish to call attention to is the brake hangers. You can make brake hangers in almost any little blacksmith's shanty and they will look like brake hangers when they are applied to the car, but the conditions of manufacture, the character of the metal used, and the methods under which the hanger was formed all contribute to making it anything but a serviceable brake hanger that will hold the brake beam in condition while the cars are routed over the lines of the various carriers. You can either buy or properly make a brake hanger with a proper cross-sectional area and by calculation you can determine its sectional modulus at its particular bend which will be anywhere from thirty-five to sixty-eight per cent stronger than the ordinary brake hanger made of round iron.

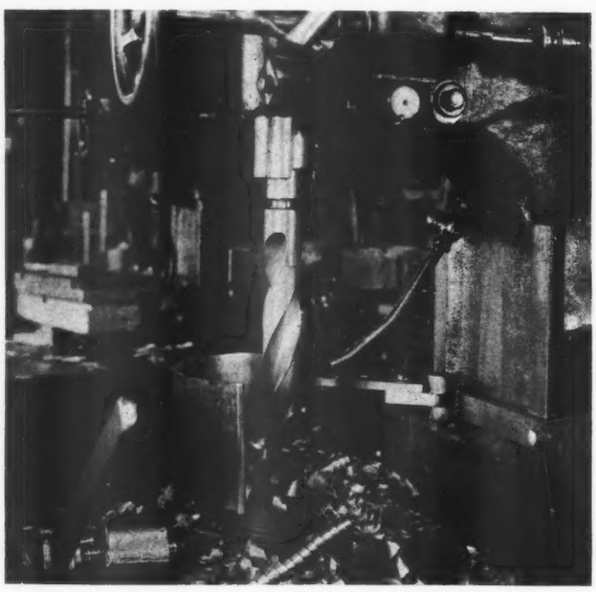
Any program that the tank car people might institute in order to apply to their cars, when they have them in their shops for general rehabilitation, tending toward the application of efficient brake hangers, either those that they make or purchase, will tend to keep their cars off repair tracks.

C. M. Hitch (district m. c. b., Baltimore & Ohio, Cincinnati): I have had occasion to be out in Mr. McBurney's territory and I know that the tank car companies in his vicinity are going farther toward maintaining their equipment than ever before. At the same time a great many tank line companies are still neglecting their equipment, so far as the maintenance of draft gears, coupler contour, brake hangers, and so on, are concerned. There hasn't been anything said here about the wear of the brake heads. I want to say that if you will all go home and make a rigid inspection of brake heads on all your equipment, both tank cars and other cars, you will be amazed at the condition you find in worn bearings where the bottom of the hanger comes in contact with the brake head. I would ask that tank-car people as well as other people pay more attention to the brake hangers as to wear of brake-hanger pins. If the tank car people will follow those items along in their maintenance of equipment it will increase the car mileage for them to a great extent.

[A further account of the proceedings will appear in next month's issue.—EDITOR.]

Chip Breaker and Guard

IN one of the departments of the General Electric Company's River Works at West Lynn, Mass., great difficulty was caused by flying chips. These chips came from a metal drill used in the cutting of special steel and were a continual source of danger not only to the workman tending the machine, but also to passers-by. In addition the fallen chips scattered upon the floor proved dangerous as well as unsightly.



Chip breaker and guard for vertical drilling machines

A novel device consisting of a breaker and guard was installed for controlling these chips. The guard prevents the chips from scattering, while the chip breaker keeps them in one position on the table. The illustration shows the arrangements of the two devices.

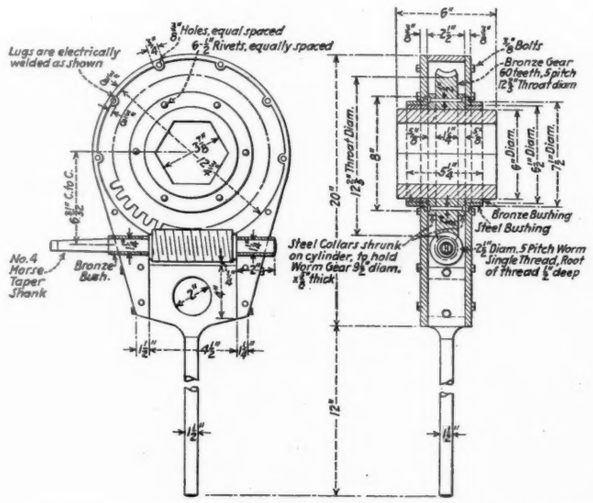
Speed-Reduction Unit Has Many Uses

By H. H. Henson

PULLING in valve or cylinder bushings, jacking up locomotives, or spotting or moving an engine for rod work, removing crown brasses, etc., requires some form of mechanical force. The illustrations show a power driven speed reduction unit which can be used to expedite the completion of the above-mentioned repair jobs, particularly in the enginehouse where adequate shop facilities are not always available.

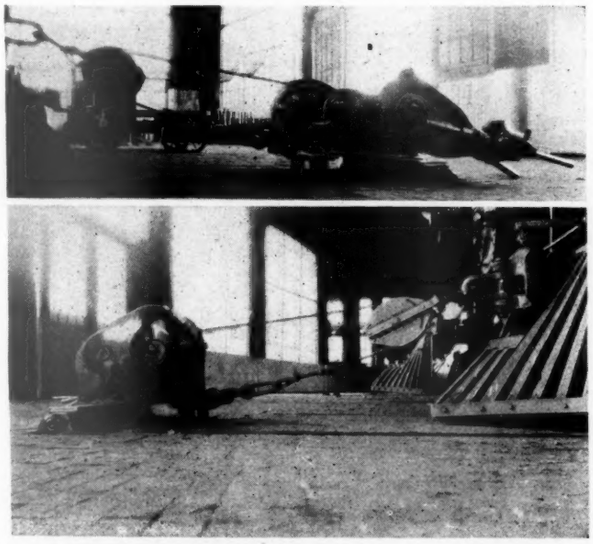
As the drawing indicates, the unit consists of a worm and gear which operate in heavy grease enclosed in a case made of ⅜-in. boiler plate. The worm gear, which is driven by an air-motor, drives the spur gear, which in turn drives a hexagon-shaped square-threaded bushing that is connected either to the end of a rod for drawing in bushings or to the handle shaft of a hydraulic jack, or to the drive shaft of a winch for moving locomotives.

Three different sizes of reduction units have been made for drawing in bushings, for operating jacks and for operating a winch. The unit for drawing in valve chamber bushings is made with a six-pitch worm and a 72-tooth worm gear, which gives a gear-reduction ratio of 12 to 1. A bar 2½ in. in diameter and 5 ft. long, with square threads at one end and U. S. S. threads cut



Construction of a reduction unit which has a 12-to-1 gear ratio

on the opposite end, is passed through the valve chamber with the bushing inserted ready to be pulled in place. A steel-forged disc is placed against the outside end of each bushing. A 2½-in. hexagon nut is drawn up against the disc that draws in the rear bushing. Over the other end of the draw rod is slipped a ball thrust bearing, which rests against the disc placed against the



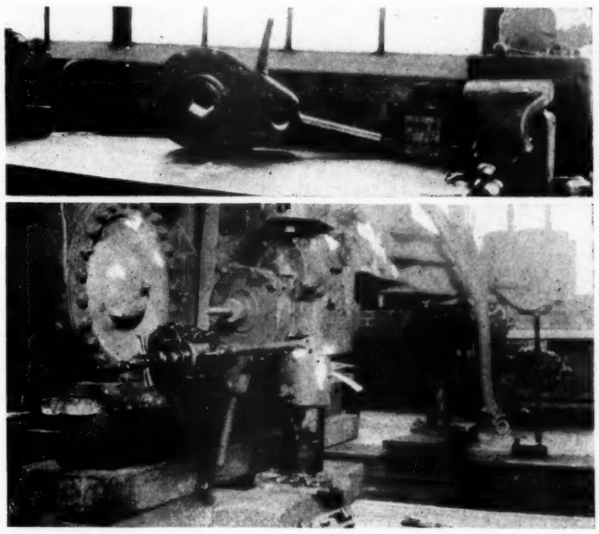
Compound gear reduction units used for moving locomotives

outer end of the front bushing. A square-thread hexagon bushing, which is 6 in. long, is screwed onto the front end of the draw rod. The reduction drive unit is slipped over this bushing. The assembly is now complete for forcing in the bushings.

A larger reduction unit is used for drawing in cylinder bushings. The unit contains a 70-tooth, five-pitch worm-gear drive, which gives a gear ratio of 14 to 1. The diameter and length of the draw rod used for this operation are 3 in. and 7. ft. 6 in., respectively.

One of the illustrations shows two reduction units driving two 100-ton hydraulic jacks placed under the front end of a 180-ton locomotive. These units contain an eight-pitch, 15-tooth worm and 75-tooth worm gear, which gives a gear ratio of 5 to 1. Each unit is attached to the jack-handle shaft. The time required to raise a locomotive after the jacks have been set and the air motors connected, is about three minutes. This set-up is used in the enginehouse.

Another of the illustrations shows a large compound-gear reduction unit driving a winch used for moving

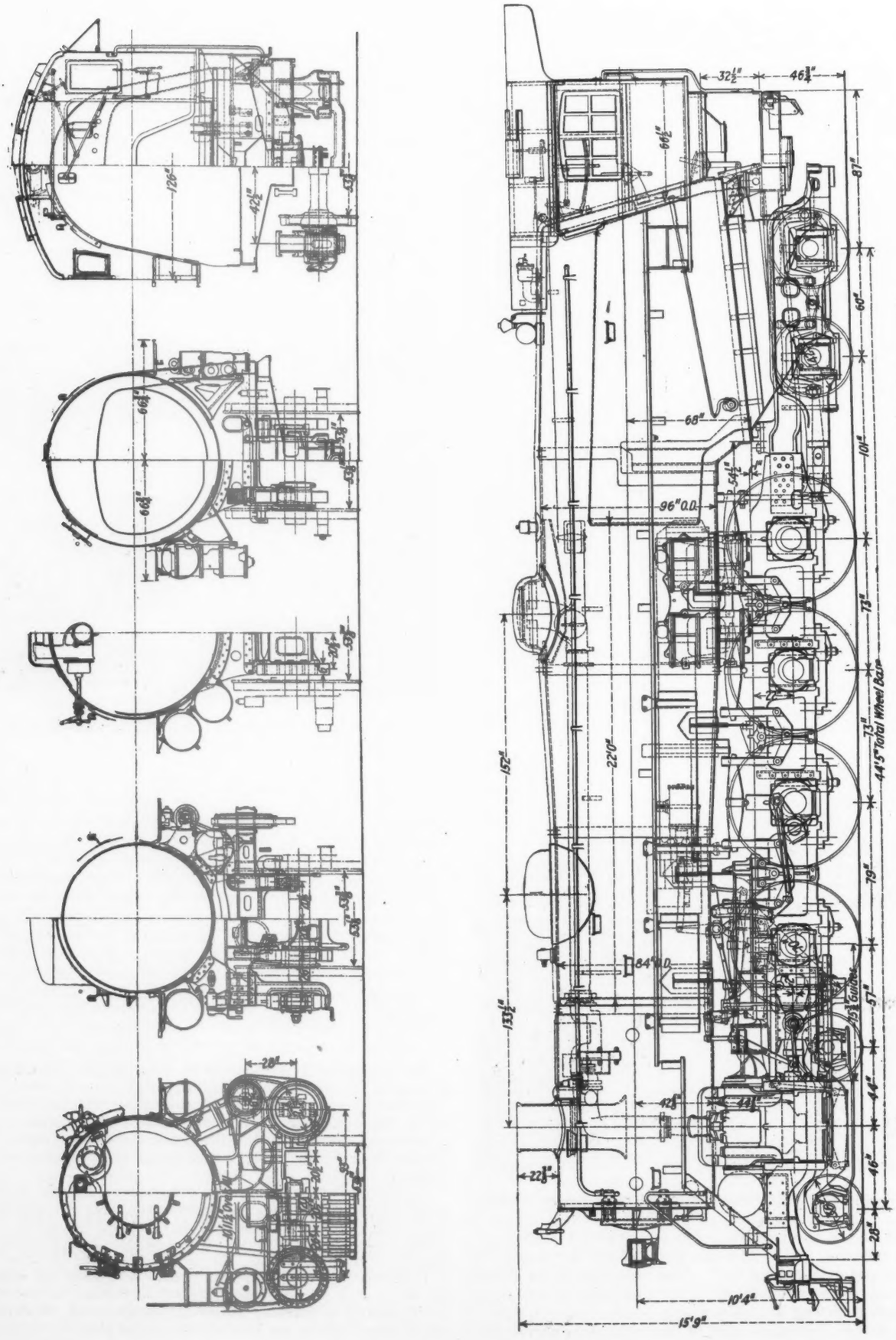


Method of using speed-reduction units for jacking up a locomotive

locomotives. The gears in this unit are all six pitch. The driving gears have 15 to 25 teeth and the driven gears have 60 and 80 teeth, which gives a gear ratio of nearly 15 to 1. The winch is firmly held in place by a 2-in. bolt, which passes through the steel stop block attached to the end of each pit rail. The illustration shows the method of attaching the winch cable to the front draw-head and to the base of the winch. The winch is used for moving locomotives in the enginehouse, for stripping the rods, setting valves, changing crown brasses, etc., eliminates the services of a hostler and a helper and an extra yard locomotive to move dead engines.

The London & North Eastern of Great Britain, according to reports of the United States Department of Commerce, plans the construction of new locomotive facilities at King's Cross, England. The report states that 178 locomotives are now assigned to the King's Cross yards and a new layout is planned there that these may be serviced in a more satisfactory manner.

Freight car repair work now being done at this yard will be transferred to the existing car repair shops at Highgate and the King's Cross car shop will be converted into a roundhouse. New ashpits will be installed together with a coaling plant of 500 tons capacity. The present hot water plant will be enlarged so that all locomotives may be washed out with hot water, while the 52-ft. turn table will be replaced by one of 70 ft., capable of handling Pacific type locomotives. Modern sand-drying facilities are also included in the plan.



Cross section and elevation drawings of the Denver & Rio Grande Western 4-8-4 type locomotive

Ten 4-8-4 Type Locomotives for the D. & R. G. W.

Designed to traverse 21-deg. curves and negotiate 3.3-per cent grades

Front view of one of the new 4-8-4 type Denver & Rio Grande Western locomotives

THE Denver and Rio Grande Western recently placed in passenger service between Denver, Colo., and Salt Lake City, Utah, ten 4-8-4 type locomotives, which were built by the Baldwin Locomotive Works. These locomotives develop a tractive force of 63,700 lb. They have 27-in. by 30-in. cylinders, 70-in. drivers, and operate at a boiler pressure of 240 lb. The total weight carried on the drivers is 264,900 lb., which, divided by the tractive force, gives a factor of adhesion of 4.16.

The new 4-8-4 type locomotives were purchased by the D. & R. G. W. on account of a shortage of passenger power, and this particular type and size was decided upon in order to provide sufficient capacity to insure the maintenance of passenger train schedules over the unusually heavy grades between Denver & Salt Lake City. A profile of the line over which these locomotives are now being operated is shown in one of the drawings. A ruling grade of 3.33 per cent, with a maximum curvature of 16 deg., located between Minturn, Colo., and the Continental Divide at Tennessee Pass, provides one of the difficulties in operating passenger trains between Denver and Salt Lake City. Other grades of 3 per cent, with a maximum curvature of 12 deg. and 2.4 per cent with a 9. deg. curvature are encountered. The new passenger locomotives were purchased with the expectation of reducing the running time over this line.

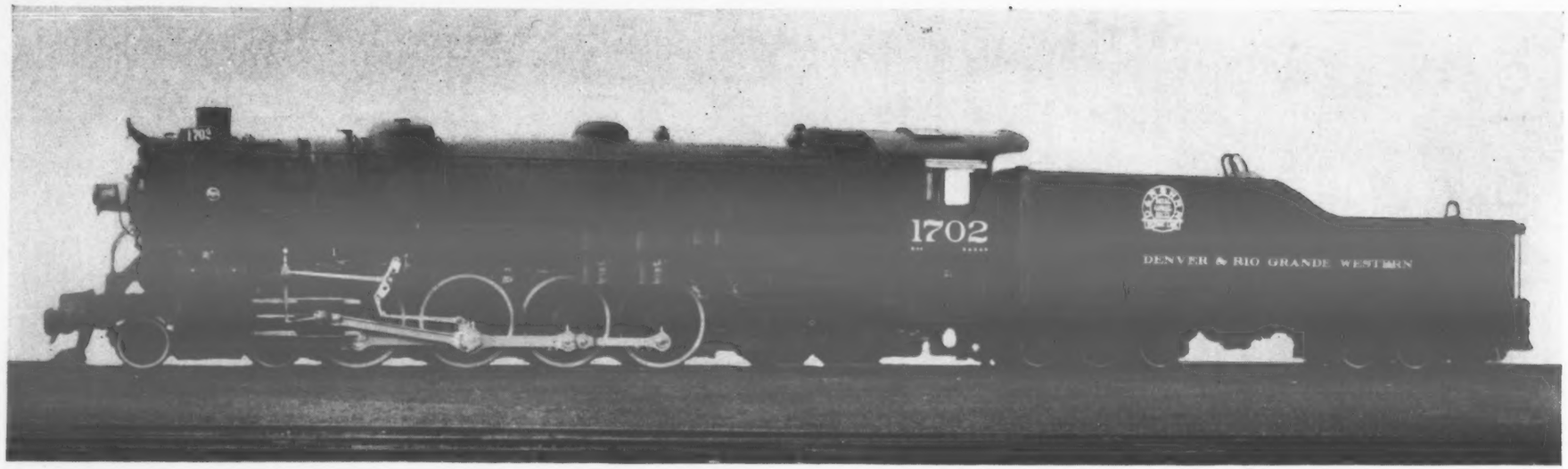
Two of the through trains between Denver and Salt Lake City are now operating on a schedule one hour shorter than that formerly in effect. The present schedule is now approximately 25 hours between Denver and Salt Lake City. While the railroad has not yet made any official test, the performance of these locomotives, from the standpoint of coal and water consumption, has proved to be satisfactory in a number of breaking-in runs which were made shortly after the delivery of the first locomotives of the order.

New Power Can Handle 15-Car Trains

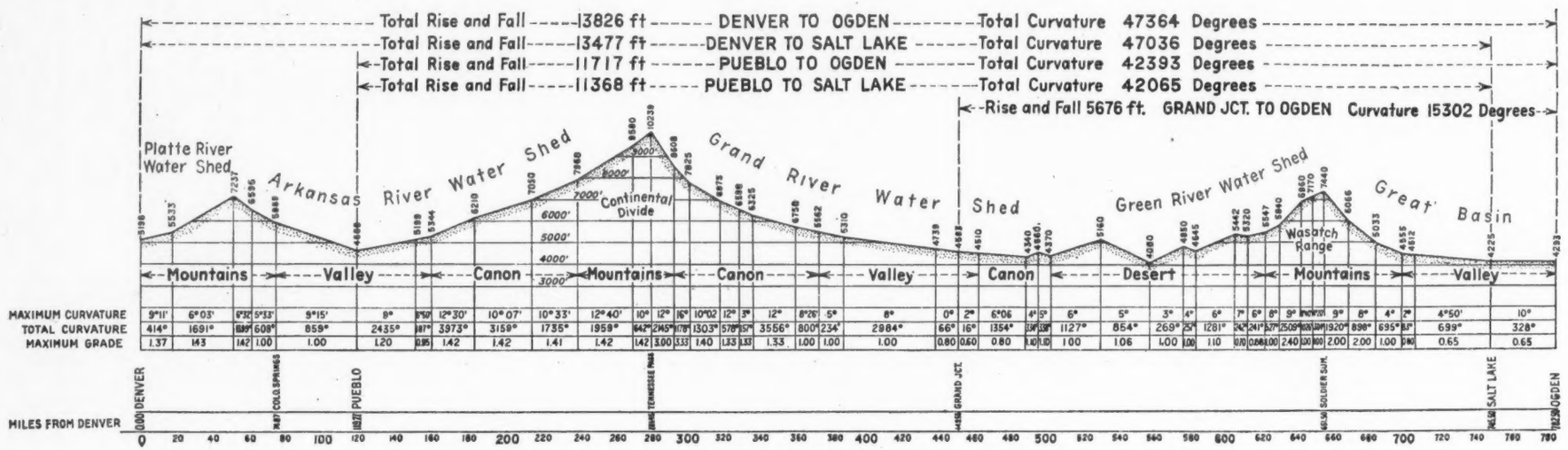
A number of breaking-in trips in both passenger and

Table of Dimensions, Weights and Proportions of the Denver & Rio Grande Western 4-8-4 Type Locomotives

Railroad	D. & R. G. W.
Builder	Baldwin
Type of locomotive	4-8-4
Service	Passenger
Cylinders, diameter and stroke	27 in. by 30 in.
Valve gear, type	Walschaert
Valves, piston type, size	14 in.
Maximum travel	7 in.
Outside lap	1¼ in.
Exhaust clearance	⅛ in.
Lead in full gear	zero
Lead at 25 per cent cut-off	3/16 in.
Weights in working order:	
On drivers	264,900 lb.
On trailing truck	87,300 lb.
On front truck	65,950 lb.
Total engine	418,150 lb.
Total engine and tender	696,750 lb.
Wheel bases:	
Driving	18 ft. 9 in.
Rigid	12 ft. 2 in.
Total engine	44 ft. 5 in.
Total engine and tender	89 ft. 9 in.
Wheels, diameter outside tires:	
Driving	70 in.
Front truck	36 in.
Trailing truck	42 in.
Journals, diameter and length:	
Driving, main	13 in. by 15 in.
Driving, others	11½ in. by 15 in.
Front truck	7 in. by 14 in.
Trailing truck	9 in. by 16 in.
Boiler:	
Type	Conical
Steam pressure	240 lb.
Fuel, kind	Soft coal
Diameter, first ring, outside	84 in.
Firebox, length and width	132⅛ in. by 96¼ in.
Combustion chamber, length	42 in.
Tubes, number and diameter	43—2¼ in.
Flues, number and diameter	195—3½ in.
Length over tube sheets	22 ft.
Grate area	88 sq. ft.
Heating surfaces:	
Firebox and combustion chamber	343 sq. ft.
Thermic syphons	103 sq. ft.
Tubes and flues	4,471 sq. ft.
Total evaporative	4,917 sq. ft.
Superheating	2,229 sq. ft.
Comb. evaporative and superheating	7,146 sq. ft.
Tender:	
Water capacity	14,000 gal.
Fuel capacity	20 tons
Wheels, diameter outside tires	36 in.
Journals, diameter and length	6 in. by 11 in.
Rated tractive force	63,700 lb.
Weight proportions:	
Weight on drivers ÷ total engine weight, per cent	63.3
Weight on drivers ÷ tractive force	4.16
Total weight engine ÷ comb. heating surface	58.75
Boiler proportions:	
Tractive force ÷ comb. heat. surface	8.94
Tractive force × dia. drivers ÷ comb. heating surface	625
Firebox heating surface ÷ grate area	5.08
Firebox heating surface, per cent of evap. heating surface	9.08



One of the 4-8-4 type locomotives recently delivered to the Denver & Rio Grande Western by the Baldwin Locomotive Works



Condensed profile of the D. & R. G. W. from Denver, Col., to Ogden, Utah

freight service were made over various portions of the line between Denver and Salt Lake City to ascertain the performance of the new power. Records of the fuel consumption were made on several of the tests, as a complete installation to the wearing parts of the cylinders and valves.

The tender is of water-leg construction, having a capacity for 20 tons of coal and 14,000 gal. of water.

Performance Record of the Denver & Rio Grande Western 4-8-4 Type Locomotives Taken on Several Trial Trips

Service	Average speed, m.p.h.	Tonnage behind tender	No. of cars in train	Coal per car-mile, lb.	Distance, Miles	Stations From	Stations To	G. T. M. per hour
Freight	19.6	1,655	....	85.7*	50	Burnham, Denver	Palmer Lake	34,400
Freight	23	1,394	....	....	23	Colorado Springs	Palmer Lake	32,050
Freight	27.6	1,250	....	....	23	Colorado Springs	Palmer Lake	34,500
Passenger	31.8	....	12	9.8	215	Denver	Salida	.....
Passenger	30.7	....	10	9.1	745	Denver	Salt Lake City	.....
Passenger	30.7	....	10	8.76	745	Denver	Salt Lake City	.....
Passenger	30.7	....	11	7.8	215	Denver	Salida	.....
Passenger	50	....	11	....	92.4	Butte	Denver	.....
Passenger	38.8	....	14	....	95	Pueblo	Salida	.....
Passenger	30.8	....	16	....	95	Pueblo	Salida	.....

* Coal per thousand gross ton-miles.

the results of which are shown in one of the tables.

These locomotives can handle trains up to 15 passenger cars from Denver to Grand Junction, Colo., a distance of 450 miles, on 20 tons of coal, and to Salt Lake City with from 35 to 38 tons of coal. It is expected that complete road tests will be made in the near future.

Design and Construction

The new Denver & Rio Grande Western 4-8-4 type locomotives are designed to traverse curves of 21 deg. and to negotiate grades up to 3.3 per cent, with the type of trains used in through passenger service. The principal dimensions, weights and proportions of these locomotives are shown in one of the tables. Steam distribution to the cylinders is controlled by 14-in. valves, operated by a Walschaert valve gear having a maximum travel of 7 in., lap of 1¼ in., and an exhaust clearance of ⅛ in. The lead in full gear is zero, but increases to ⅜ in. at 25 per cent cut-off. This variation in lead is obtained primarily by changing the length of the short arm of the combination lever, with the change in cut-off.

Referring to the arrangement of the valve gear as shown on the elevation drawing, it will be observed that a bell crank and connecting link have been introduced between the radius rod and combination lever. Provision has been made in the construction of the combination lever to vary the distance, center to center, between the pin connection to the valve stem and the pin connecting the lever to the radius rod, from a maximum of 3⅞ in. to a minimum of 2⅞ in. This variation in distance affects the length of the lap and lead travel of the valve.

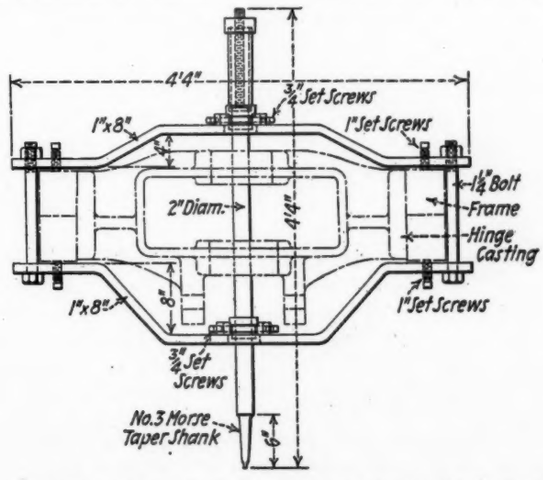
Special Equipment

The locomotives are equipped with Elesco feedwater heaters, which are located under the smokebox and in front of the cylinder saddles. Superheated steam is used to operate the feedwater pump, Standard stoker, headlight generator, blower and two 8½-in. cross-compound air compressors. In addition to the special equipment mentioned, these locomotives have Type E superheaters and Alco power reverse gears. The cylinders and tender frames are cast steel. The piston rods, main rods and side rods are of carbon-vanadium steel. Floating bushings are applied on all crank pins, including the main-rod back ends. The main drivers are cross-balanced. Hunt-Spiller gun iron is applied

It is carried on two six-wheeled trucks of cast-steel frame construction. The total loaded weight of the tender is 278,600 lb.

Jig for Boring Holes in Hinge Castings

THE device shown in the drawing is used for boring articulating pin holes in the hinge casting and engine truck center pin casting used on articulated locomotives. It is operated by a compressed-air motor, the mandrel of which fits over the No. 3 Morse taper



Device for boring articulating pin holes in the hinge casting and engine-truck center-pin casting of articulated locomotives

shank on the end of the boring bar. Provision is made for securing two cutting tools to the boring bar by means of clamps secured to the bar by four ½-in. machine screws.

The jig is secured to the casting, the outline of which is shown on the drawing by dotted lines, by means of two 1¼-in. bolts and four 1-in. set screws. The frame members are forged from 1-in. by 8-in steel, drilled to suit. The feed mechanism for the boring operation

consists essentially of two special nuts tapped to screw over the threaded end of the boring bar. These nuts are made of brass 3¼ in. in diameter and are held in position by the ¾-in. set screws as shown in the drawing. A thread 1 in. in diameter, 16 threads per inch, is cut on the end of the boring bar, a distance of 11 in., which provides a feed of considerable latitude.

Decisions of Arbitration Cases

(The Arbitration Committee of the A. R. A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Passenger Car Damaged in Hump Switching Service

On October 10, 1927, the New York, New Haven & Hartford rendered a car-repair bill of $76.13 to the American Railway Express Company for repairs to car No. 1130 which had been damaged in switching service. The owner took exceptions to the charge, claiming that the pasesnger car had been damaged in regular freight switching service, which should be considered as improper handling under Rule 8, Paragraph 4, of the 1927 Code. The handling line contended that the car had been damaged when a freight car with rider protection was coupled to the A. R. E. car and that, since no other cars had been damaged, derailed, cornered, side-swiped or subjected to rough handling in accordance with Rule 32, the damage was the owner's responsibility.

In rendering its decision the Arbitration Committee stated that "The car was not subjected to any of the unfair conditions set forth in Passenger Car Rule 8. The owner is responsible."—*Case No. 1599—New York, New Haven & Hartford vs. American Railway Express.*

Responsibility for Applying Lock Nuts Not Standard to Cars

The Central of Georgia rendered to the St. Louis-San Francisco, a bill for the application of grip nuts to 179 Frisco freight cars. The grip nuts were applied principally to journal box bolts. The owner, claiming that the grip nuts applied were not standard to its freight car equipment, declined payment for the application of grip nuts, lock nuts or common jam nuts applied over regular nuts. The Central of Georgia stated that its inspectors noticed that some of the Frisco cars passing through the terminals were equipped with lock nuts applied to the journal-box bolts. Assuming that this was standard practice on the Frisco equipment, all missing lock nuts were applied as the cars passed through inspection terminals. The handling line maintained that the repairs made by its forces were properly made and that they were not applied over unit nuts. The handling line also contended that the owner should provide joint evidence covering the alleged wrong repairs for each car within the specified time of 90 days after first receipt of the car on the home line after the repairs had been made. On this point, the owner felt that the rules do not contemplate that it should be expected to locate hundreds of cars for the purpose of obtaining joint evidence to support the statement that grip nuts are not standard.

In its decision the Arbitration Committee stated:

"A. R. A. Standards provide as follows: Nut locks or lock nuts for column bolts and journal-box bolts. However, nut locks or lock nuts are not required in addition to special 'unit' nuts. Nuts in connection with the brake wheel or brake shaft shall be secured by riveting over or by the use of a lock nut or suitable cotter. However, the lock nut should not be used where the brake shaft is already drilled for the use of a cotter. Bolts securing brake cylinders, auxiliary reservoirs and pipe clamps, shall have double nuts or lock nuts, preferably the latter. Except as above provided, nut locks and lock nuts if used on other details are not chargeable to the car owner, unless nut locks, lock nuts or double nuts are the standard of the car. In this connection, the positive statement of the owner that they are not the standard of the car, will be considered as sufficient evidence." *Case No. 1600—St. Louis-San Francisco vs. Central of Georgia.*

Axle Removed Because of Seamy Journal

On September 7, 1929, the Union Pacific applied a pair of wheels to Kansas City Southern car No. 14190 because of a seamy journal, both wheels OK and the axle scrapped. The K. C. S. contended that the defect could not be classed as a seamy journal. During the investigation it developed that the car had had a hot box and doubtless was bad-ordered for a cut journal. The defect on the axle ran around the journal instead of from the back fillet towards the collar which is the characteristic mark of a seamy journal. Therefore, the owner contended that the defect should be classed as a cut journal which makes it chargeable to the delivering line.

In rendering its decision the Arbitration Committee stated that "the position of the Union Pacific is not sustained. The delivering line is responsible for a damaged journal due to heating when the journal requires reconditioning for use or when the axle is scrapped as unfit for reconditioning, regardless of the actual cause of the heating."—*Case No. 1601—Kansas City Southern vs. Union Pacific.*

Wheels Changed by Intermediate Road on Authority of Defect Card

The St. Louis-San Francisco issued its defect card, dated March 24, 1927, to cover one pair of cast-steel wheels, slid flat under TCX car No. 8689. Cast-steel wheels are standard for the car. On March 27, 1927, the Chicago, Rock Island & Pacific replaced the slid-flat cast-steel wheels with a part of multiple-wear wrought-steel wheels and charged the Texas Company for the value of the wheels applied, allowing credit for the scrap cast-steel wheels removed. The C. R. I. & P. bill also included labor charge for the application of the wheels and the dust guards, and a material charge for journal bearings and dust guards. The wheels applied had respectively 3/16 in. and 5/16 in. of service metal when applied. The value of these wheels, including the metal inside of the condemning limit, was $12.48, under Rule 101, while the value of the cast-steel wheels removed, before they were made defective, was $36 under the same rule. The owner contended that in an exchange of this kind it should be reimbursed for the difference in value of the wheels removed and the

wheels applied, and that the labor and material charge should be billed against the road issuing the defect card. The Texas Company also pointed out that Rule 98 does not specifically define the responsibility of the owner, of the road issuing the defect card, and of the road making the repairs under the conditions outlined and, therefore, it requested the Committee to define such responsibility for the purpose of arriving at a basis for future billing.

In rendering its decision the Arbitration Committee stated that "In this case the owner is entitled to credit at second-hand value for the slid-flat cast-steel wheels. Therefore, in rendering the counterbill on authority of the defect card, under the principle of Rule 98, Section (f), last paragraph, the owner is entitled to charge the difference between the value of second-hand and scrap cast-steel wheels, plus material charge for journal bearings and dust guards as well as the labor involved. The owner should assume the cost of wrought-steel wheels applied."—*Case No. 1602—Texas Company vs. St. Louis-San Francisco.*

A Unique Case Involving Wheel Repairs

The Interstate Railroad rendered a bill for $135.74 against the Chicago, Rock Island & Pacific for the correction of wrong repairs on I. N. T. car No. 15495, on authority of a defect card issued against C. R. I. & P. for two pairs of cast-iron wheels in place of wrought-steel wheels when the car was delivered to the Elgin, Joliet & Eastern on August 2, 1927. The location of the wrong wheels was given on the defect card as R. & L. 1 and R. & L. 3. The C. R. I. & P. did not apply the cast-iron wheels to the I. N. T. car and overlooked securing a defect card for the wrong repairs when it received the car from the connecting line. The Interstate road furnished a statement with its bill that the records had been searched and that it had failed to find a repair card showing the substitution of cast-iron wheels for wrought-steel wheels under the car in question but it did have a repair card from the Missouri Pacific, dated March 15, 1927, showing the removal of cast-iron wheels R. & L. 4 and the application of cast-steel wheels to the same location because of a cut journal. This pair of wheels was one of the two pairs of cast-iron wheels under the car when the defect card was issued against the C. R. I. & P., August 2, 1927. The C. R. I. & P. objected to the charge for two pairs of wheels and requested that the charge for one pair of wheels be eliminated from the bill because it considered the Missouri Pacific responsible for this portion of the wrong repairs. The owner maintained that the C. R. I. & P. was responsible for the correction of wrong repairs for both pairs of wheels and refused to make any change in its charges.

In rendering its decision the Arbitration Committee stated that "In view of the note following Rule 70, the contention of the Chicago, Rock Island & Pacific is sustained. The Missouri Pacific is responsible for application of one pair of wrong wheels notwithstanding the error in recording the location of the wheels."—*Case No. 1603—Chicago, Rock Island & Pacific vs. Interstate Railroad.*

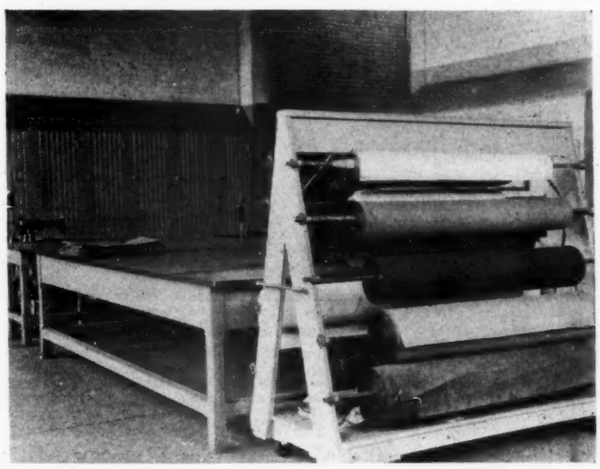
Owner Responsible for Damaged Tank Car Under Rule 44

Included in the repair bill rendered on October 21, 1926, by the New York, New Haven & Hartford for repairs to U. S. F. X. car no. 1027 was a charge for repairing two bent center sills. The owner objected to the charge as no statement was attached as per Rule 44. The repairing line furnished a statement which the owner felt did not meet the requirements of Rule 44 and therefore requested a cancellation of the charge. The repairing line furnished a statement signed by the car foreman showing how the accident occurred and what damage was done. The owner maintained that a statement furnished by a freight-car foreman is not sufficient evidence since he could not possibly have accurate knowledge of how the damage occurred and that the conductor's report would be the only accurate information regarding the damage. The repairing line contended that a statement furnished by a repairing company can be compiled and signed either by a transportation or mechanical representative and is authentic when it contains the facts according to A. R. A. Rules.

In rendering its decision the Arbitration Committee stated that "The statement furnished by the repairing line showing the circumstances under which the car was damaged is sufficient to definitely place the responsibility, under Rule 44, upon the owner. The contention of the New York, New Haven & Hartford is sustained."—*Case No. 1604—New York, New Haven & Hartford vs. Solox Car Line Corporation.*

Upholstery Room Measuring Equipment

THE measurement of materials is made easy in the upholstery department by the use of the table and rack shown in the illustration. The measuring table is 8 ft. wide by 15 ft. long with a metal strip along one edge, which is laid off as a yard sick for measuring material. A sewing machine is located at one end, the material rack at the other, while large windows at the side supply ample light for the work.



Convenient equipment for the upholstery room

The rack, which holds 10 rolls of material, is 7 ft. long, 6 ft. high, and is made in the shape of an inverted vee, 3 ft. wide at the bottom. The rolls of material are slipped over sections of 1-in. pipe, of which five are hung on each side of the rack. The pipes fit in hooks as the ends of the rack. The rack is mounted on castors and has a handle bolted across each end by which it is moved.

Traveling Engineers Gather for Annual Convention

Large attendance at Chicago meeting—Extensive exhibition of railway equipment and supplies

OVER 1400 members and guests of the Traveling Engineers' Association met for the thirty-seventh annual convention of this body at the Hotel Sherman, Chicago, September 24 to 27, inclusive. Aside from the addresses and committee reports, the feature of the convention was unquestionably the large exhibition of railway equipment and supplies displayed under the auspices of the Railway Equipment Manufacturers' Association. The exhibits, brought to the convention by 126 representative companies, covered the latest developments in practically every item of equipment used in connection with steam locomotive service. In view of the keen interest and large amount of time which the traveling engineers spent in the exhibition hall, it is evident that this feature of the convention was at least as valuable from an educational standpoint as information developed on the convention floor itself.

Officers and Executive Committee Members of the Traveling Engineers' Association

Top row, left to right: J. D. Heyburn (St. L.-S. F.); J. P. Stewart (Mo. Pac.); B. J. Feeney (I. C.); E. R. Boa (N. Y. C.); D. L. Forsythe (St. L.-S. F.), and R. A. Phair (Canadian National), second vice-president—Middle row: M. G. Macias (National Lines of Mexico); F. P. Roesch (Standard Stoker Company); W. O. Thompson (N. Y. C.), secretary; J. Fahey (N. C. & St. L.), president; Ralph Hammond (N. Y., N. H. & H.), first vice-president; J. B. Hurley (Wabash)—Bottom row: C. I. Evans (M-K-T); J. M. Nicholson (A., T. & S. F.), fourth vice-president; J. N. Clark (Sou. Pac.); D. I. Vergan (Wabash), and A. T. Pfeiffer (N. Y. C.), fifth vice-president.

During the course of the convention, addresses were presented by Samuel O. Dunn, editor of the Railway Age, L. K. Sillcox, assistant to the president of the New York Air Brake Company, Watertown, N. Y., and C. E. Hill, general safety agent of the New York Central Lines, New York City. Six committee reports were presented on the following subjects: "To What Extent Have Modern Appliances Contributed to Economical Operation of Locomotives?"—Chairman E. R. Boa, road foreman of engines, New York Central, Buffalo, N. Y.; "The Better Utilization of the Steam Generated by the Locomotive in Heating and Ventilating of Passenger Cars"—Chairman T. W. Kennedy, assistant air brake lubrication and heating engineer, Illinois Central, Memphis, Tenn.; "Preparation and Testing of Air Brake Equipment To Insure Proper Train Handling"—Chairman D. H. Varnell, road foreman of engines, Texas & Pacific, Big Spring, Tex.; "Utilization and Conservation of Available Coal and Oil as Locomotive Fuel"—Chairman J. W. McIlvaigh, road foreman of engines, Missouri Pacific, St. Louis, Mo.; "History of the Traveling Engineers' Association from Its Inception to Date"—Secretary W. O. Thompson, equipment assistant, New York Central, Cleveland, Ohio; "Progress in Construction and Operation of Locomotive Mechanical Stokers"—F. P. Roesch, Standard Stoker Company, Chicago.

Individual Addresses

In addressing the convention on the general subject of the present railway situation, Samuel O. Dunn, editor of the Railway Age, said that in most respects 1929 is proving one of the best railroad years in history. Freight business is being handled with a substantially smaller number of cars, only 6 per cent of which are in bad

order. For this kind of service, Mr. Dunn said that the public is paying the lowest average freight rate since 1922 and at the same time is collecting taxes from the railways at the rate of $30,000,000 a year more than ever before. As the result of the great increase in railway efficiency, the railways are, however, earning a net return at the annual rate of about 5.6 per cent on their property investment, a figure which has not been equalled in any year since 1916. Mr. Dunn urged that the railways be given an opportunity to raise and invest all the capital required for further expansion and improvement of their service. He closed his remarks with a tribute to the traveling engineers who, as supervisors of locomotive operation, must be depended upon as much as any other one single group in further improvements in railway operation.

In discussing the subject "Trains of Tomorrow," L. K. Sillcox, assistant to the president of the New York Air Brake Company, reviewed in detail the progress which has been made to date in the design and use of railway equipment and, with that as a background, pointed out the probable trends of future development. The increase in average train speed in recent years has been brought about not only by the use of modern power, but by reducing the number of stops and delays. He predicted that the efficiency of operation of various railways will, in the future to a greater extent than ever before, be measured by the tons moved per freight-train hour. He also predicted still further increases in average train weight, net revenue tonnage, reliability in operation and overall economy, by reason of detailed improvements in signaling, right of way and terminals, as well as equipment design.

Charles D. Hill, general safety agent of the New York Central Lines, brought the subject of safety to the attention of the convention in a forceful address in which he stated that traveling engineers have an opportunity to assist materially in safety work by studying the accident cases on their individual railroads and divisions, determining the causes and, so far as possible taking preventive measures against the recurrence of such accidents. An analysis of railway accidents last year indicates that 2 per cent were unavoidable, 6 per cent due to physical conditions and 92 per cent to the human element. This leaves plenty of opportunity for improvement in accident prevention efforts, particularly as relates to creating in railroad men of all classes, first, a desire for personal safety, and, second, a knowledge of how to obtain it. To secure the maximum results in safety work, Mr. Hill said that traveling engineers must believe in safety; recognize their personal responsibility; support safety work actively; be a leader in safety campaigns; develop an intimate knowledge of accident causes; and resolve that what others can do in safety work, they can do.

Election of Officers

In accordance with the usual custom of the Traveling Engineers' Association, the officers for the year 1928-1929 were advanced, the new officers for the coming year being: President, Ralph Hammond, road foreman of engines, New York, New Haven & Hartford, Providence, R. I.; first vice-president, R. A. Phair, road foreman of engines, Canadian National, Montreal, Que.; second vice-president, H. B. Kelly, general road foreman of engines, Pittsburgh & Lake Erie, McKees Rocks, Pa.; third vice-president, J. M. Nicholson, fuel conservation engineer, Atchison, Topeka & Santa Fe, Topeka, Kan.; fourth vice-president, A. T. Pfeiffer, road foreman of engines, New York Central, Syracuse, N. Y.; fifth vice-president, D. L. Forsythe, general road foreman of equipment, St. Louis-San Francisco, Springfield, Mo.; treasurer, David Meadows, Michigan Central, St. Thomas, Ont.; secretary, W. O. Thompson, equipment assistant, New York Central, Buffalo, N. Y. G. A. Haslett, general road foreman of engines, Seaboard Air Line, Tampa, Fla., and J. J. Kane, road foreman of engines, Lehigh Valley, Sayre, Pa., were elected new members of the Executive Committee, the other members of which include F. P. Roesch, sales manager, Standard Stoker Company, Inc., Chicago; B. J. Feeney, superintendent of fuel conservation, Illinois Central, Chicago; E. R. Boa, road foreman of engines, New York Central, East Buffalo, N. Y.; G. A. Kell, safety engineer, Canadian National, Toronto, Ont.; J. C. Simino, traveling engineer, Southern Pacific, Lafayette, La.; M. A. Daly, general fuel supervisor, Northern Pacific, St. Paul, Minn.; G. C. Jones, master mechanic, Atlantic Coast Line Jacksonville, Fla.; M. G. Macias, assistant general superintendent, National Lines of Mexico, Mexico City, Mex.; C. I. Evans, chief

Group of Officers and Executive Committee Members of the Traveling Engineers' Supply Association

Standing, left to right: Thomas O'Leary (Johns-Mansville Corporation); C. F. Weil (American Brake Shoe & Foundry Company); R. R. Wells (Hunt-Spiller Manufacturing Corporation)—Seated: E. H. Weaver (Westinghouse Air Brake Company); L. B. Rhoades (Vapor Car Heating Company), first vice-president; C. M. Hoffman (Dearborn Chemical Company), president; H. S. Mann (Standard Stoker Company), and R. T. Peabody (Air Reduction Sales Company)

fuel supervisor, Missouri-Kansas-Texas, Parsons, Kan.; A. White, general road foreman of engines, Southern, Charlotte, N. C.; W. L. Robinson, superintendent of fuel and locomotive performance, Baltimore & Ohio, Baltimore, Md.; D. I. Bergin, assistant general road foreman engines and fuel supervisor, Wabash, Decatur, Ill.; J. N. Clark, chief fuel supervisor, Southern Pacific, San Francisco, Cal.; J. P. Stewart, general supervisor of air brakes, Missouri Pacific, St. Louis, Mo.; J. B. Hurley, general road foreman engines and fuel supervisor, Wabash, Decatur, Ill., and J. D. Clark, fuel supervisor, Chesapeake & Ohio, Richmond, Va.

Report on Air Brakes

Your committee entrusted with the subject "Preparation and Testing of Air Brake Equipment To Insure Proper Train Handling" assume that this paper very properly should supplement the paper entitled "Train Handling" presented before this association in 1928, because in that presentation we feel that the entire subject of train handling was exhaustively covered and in consequence thereof needs no further collaboration.

The design of air brake equipment and the installation to vehicles and the design and installation of foundation brake gear cannot properly come under the heading entrusted to your committee because we feel that once this equipment has been installed it is impossible for any one preparing cars or locomotives for road service to modify or change it; however, mention must be made of the necessity, if proper train brake operation is to be obtained, for the original design and installation to be of such character that all the best engineering experience and knowledge will be incorporated and it is our experience that modern equipment meets these requirements.

That the extra important features of proper installation of equipment be more firmly impressed upon all connected therewith we take occasion to mention the necessity of providing in the installation of both freight car and passenger car equipment sufficient flexibility of piping, particularly of the brake pipe branch pipe to avoid leakage produced by strains; the taking air out of the top of the brake pipe; the provision of properly-designed dirt collectors, and brake cylinder protectors to prevent the entrance of foreign matter into equipment which, after the most careful and thorough preparation, is in condition to operate satisfactorily in service only when properly protected from moisture and dirt. On passenger cars this also includes the strainer cap of the UC equipment; the modernization of the later forms of Universal equipment on passenger cars not so provided as they pass through the shops for repairs to include the quick service feature and the synchronization of application and release. In other words, while it is freely admitted that passenger trains can be and are successfully handled when the several different designs of air brake equipment such as the LN, PC and UC and even the PM equipment are installed on the various cars, still we must admit that better train handling can be obtained and, in fact, is demanded when all cars in the train have modern equipment.

Testing and repairing of locomotive brake equipment and preparing brake equipment on passenger and freight cars must be strictly in accordance with A.R.A. rules as follows: (The committee quoted at this point from the A.R.A. rules for testing and repairing all classes of air brake equipment.—EDITOR).

In conclusion, your committee wish to stress the importance of keeping train brake pipe leakage to the minimum. The rules permit a maximum leakage of seven pounds, but true economy of operation and improved train handling will be obtained by limiting the maximum train brake pipe leakage permitted. It is generally acknowledged that if brake pipe leakage is not greater than two or three pounds per minute, the handling of long freight trains becomes an easy matter for the engineer.

Economy is effected by lowering the rate of brake pipe leakage for the reason that air compressor labor is reduced. If we accept the figures given us by an authority that 97 per cent of the air compressor labor is wasted in supplying leakage and but 3 per cent used in actual brake effort and then visualize what it is costing in steam consumption to produce air pressure, the ability to economize becomes apparent; for example, if in supplying leakage, an 11-in. air compressor runs continually at a speed of 100 single strokes per minute, the actual steam used per minute is the equivalent of filling a pipe 11 in. in diameter and 60,000 ft. or more than 11 miles in length. Clearly the wastage caused by excessive leakage and the opportunity for economy in keeping it down to a closer than 7-lb. maximum is apparent, together with the ability to obtain more efficient train brake handling.

The report was read by Chairman D. H. Varnell, road foreman of engines, Texas & Pacific, Big Spring, Tex.

Discussion

In the discussion of this report, one member emphasized the fact that it is useless to tighten leaks in the train line without at the same time tightening clamps which hold all parts of the equipment, including pipes, auxiliary reservoirs and other parts of the brake equipment. Control of the train line pressure gives absolute control of train braking, according to another member who strongly urged the necessity of maintenance methods which will eliminate train line leaks. There was considerable discussion of the graduated release method of stopping trains as compared to the so-called two reduction methods. It was stated that either method could be used successfully by the proper instruction of enginemen in handling the brakes. The consensus was that graduated release permits making smoother and more accurately-controlled stops. One member said, however, that enginemen should be instructed in the use of graduated release equipment in the test car before being asked to operate it in actual service on the road.

Construction and Operation of Stokers

By F. P. Roesch
Sales Manager, Standard Stoker Company, Chicago

The first successful locomotive stokers, developed to meet all conditions, were, in the light of present practice, quite intricate and complicated. They did a mighty good job of firing, we must admit, and when conditions were favorable, i. e., not too many big pieces of tramp iron mixed with the coal, were absolutely reliable and went along about their business without hesitation—but when a piece of tramp iron got caught in the conveying system, Old Man Trouble was right on the job, and therefore it was necessary to so design the machine as to enable the operator to cut out any one of the conveyor or elevator units in order to determine with the least loss of time just where the obstruction was located. All this, of course, meant more mechanism, and more mechanism meant more parts to look after, to lubricate, to keep in

repair, and to possibly fail. Therefore, in the further development of the locomotive mechanical stoker, instead of adding parts as in the case of the air brake, one of the stoker companies started on the process of elimination. They recognized the fact that as long as coal is handled as it is at present we can always expect to find a certain amount of foreign matter, such as tramp iron, wood, old overalls, etc., mixed with it, and the proper thing to do was to eliminate so far as possible such parts of the stoker mechanism as seemed to cause the most trouble from this source.

Their investigations and records showed that as a general proposition the smaller pieces of tramp iron, such as track spikes, brake shoe keys, mining machine bits and cutters, caused the most delays, catching in the conveying mechanism where the direction of travel was changed, viz., from the horizontal to the vertical. Therefore it appeared that the logical thing to do was to eliminate the vertical screw, if possible. As this on trial was found to be perfectly feasible, it was done. It was then found that while tramp iron of reasonable size could be passed through the stoker without any trouble, medium sized pieces, such as mine car coupling chains, short clinker hooks, brake rods, etc., would sometimes hang up at the conveyor screw bearings, and while they did not stop the machine, they did affect its operation; therefore it was decided to eliminate these also, and as a result a stoker was developed with no vertical screws, no bearings, no paddles, or anything else in the conveying system except the crusher, that would present any obstacle to the free movement of any piece of foreign matter of a reasonable size that might be mixed with the coal; consequently when the stoker stopped, there was but one place to look for the obstruction, viz., at the crusher.

The distributing system was another problem. Various means were employed. Steam jets, plungers, moving vanes, paddles, etc., and while each method had its advocates, yet eventually they simmered down to three general designs; viz., strictly mechanical as in the alternating paddle type, semi-jet and paddle or moving vane type, and the straight steam jet type.

While each system of distribution gave excellent results, yet owing to the additional mechanism required for straight or semi-mechanical distribution, with its attendant limitations and high maintenance cost, and considering the better control over the distribution with adjustable steam jets, the latter method was finally accepted by the railroads as best adapted to meet all requirements.

So you see that the development of the mechanical locomotive stoker was not a problem of added refinements, but a question of the elimination of all troublesome and unnecessary parts—the construction of a machine that was absolutely dependable under all ordinary conditions of service—a machine that would stand up against abuse and rough usage, and with the delivery and distribution wholly under the control of the fireman at all times—a machine driven by a rugged low-speed engine of a design familiar to all railroad mechanics.

Further, it was recognized that the general arrangement of the stoker must be such as to make it readily applicable to any type of locomotive, which meant that the stoker drive engine could be located on any part of the locomotive or tender best suited for the purpose.

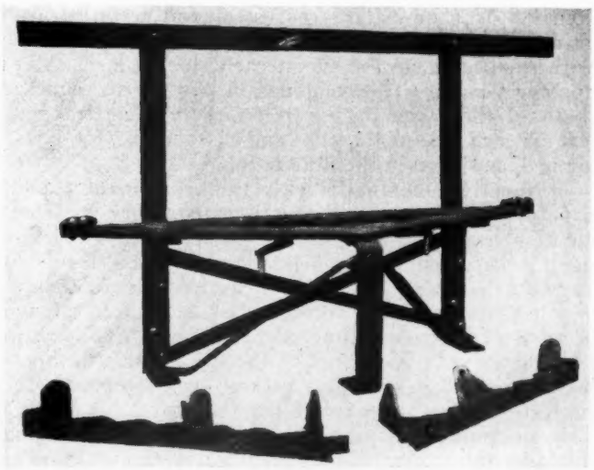
The whole job required a lot of time, patience, study, money, and (last but not least) the full and hearty cooperation of the railroad officers and employees, but, nevertheless, the end justified the means, and in the stoker of today you will find incorporated and combined the best thoughts of all the stoker designers, manufacturers and operators developed during the past thirty years.

Present General Stoker Features Unlikely To Change

Therefore, in closing, we feel that we can say without any hesitation the stoker of today will remain substantially as now designed. It has met the test of service. There is nothing left to eliminate. It can be applied to any type of locomotive. It is successfully and economically firing the largest locomotive in the world having an estimated maximum coal consumption of over thirty thousand pounds per hour, burned on a grate of 184 sq. ft. area, as well as engines with a maximum coal consumption of but 2,000 lb. per hr. burned on a grate of 21 sq. ft. area. A few refinements, such as coal measuring devices, semi-automatic control, etc., may and undoubtedly will be added later on, but so far as the general design is concerned, it will remain substantially the same, unless the general design of locomotives is changed; or, in other words, a real, reliable and almost fool-proof mechanical locomotive stoker is here, and here to stay. It has proven its economy and its efficiency, and as mechanical operation instead of hand labor is the slogan of today, it would appear that a locomotive without a stoker is as incomplete in the present era as one without an air brake.

Metal Pilots on the C. & E. I.

ON the Chicago & Eastern Illinois locomotive pilots were being maintained in wood with the exception of locomotives recently purchased which had been received with metal pilots. The wood and metal pilots on these locomotives were maintained in kind, the larger number of the locomotives having wood pilots.

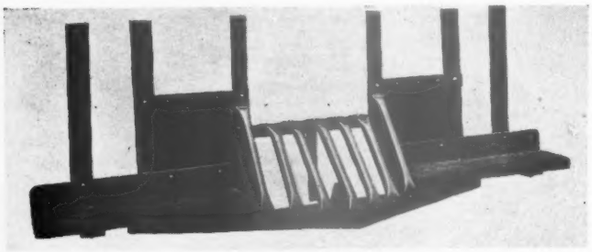


Assembling rack for C. & E. I. metal locomotive pilot

A check indicated that considerable repair work and many renewals were necessary in connection with wood pilots, and as a result a new metal pilot designed by S. A. Schickedanz, mechanical engineer, has been adopted as standard for all renewals of locomotive pilots.

In this check it developed that the average life of a wood pilot is 2.4 years, and a conservative estimate of the life of a metal pilot is assumed to be 10 years. It was found that the cost of manufacturing a new metal pilot is about 36 per cent more than the cost of a wood pilot.

The service on the C. & E. I. requires that certain locomotives be used in both road service and yard service, and, therefore, while in road service, should be equipped with a road pilot, and while in yard service, with footboards. Also a number of locomotives used in mine service are known as mine locomotives which operate in mine districts, switching coal cars around the mines and then collecting these cars at some central point in the mine district, in which service it would be preferable to have them fitted with footboards for switching service. These locomotives periodically have



Slight alterations permit application of footboards for use on switchers

to be run to the nearest terminal for washing boilers, special inspection, etc., and in such cases should have a road pilot. There are also cases where locomotives are used in local service for a time, and then transferred to yard service, or vice versa.

In designing a new metal pilot the above-mentioned facts were taken into consideration, and a pilot was so designed that it could be built as a road pilot, as shown in the illustration, or could be built as combination road and switcher pilot, as also illustrated. The road pilot consists of combination cast steel and wrought iron frame to which scrap boiler tubes are riveted for slats, with small cast steel steps on each side to meet safety appliance rules. The combination pilot is the same as the road pilot, with the exception of three vertical slats left off each side of the pilot and a section of footboard applied, as shown in the illustration.

Locomotives equipped with this combination pilot have a pilot construction that is satisfactory for combination road and yard service, or mine service. The pilot is designed with a bracket in the base frame to support the inner end of the sections of footboard, which simply requires vertical slats to be left off and sections of footboard attached to this pilot, as shown in the illustration. A portion of the space above the footboard is closed in solid by a pressed tank-steel sheet for protection of the men riding the footboard.

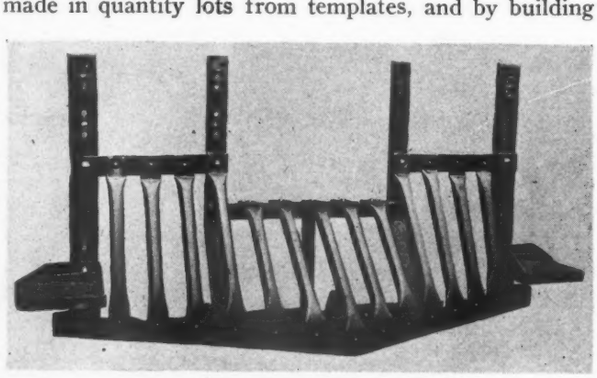
In designing this pilot, the time required for laying out and fabricating the various parts was held to a minimum to keep down the labor costs, and parts were so designed that they could be made from templates in quantity lots, with the idea that these pilots could be built in quantity lots instead of one or two at a time.

The front V-shaped bottom members consist of steel castings riveted together in the center with a vertical sawtooth flange to which the metal slats are riveted, these steel castings having the necessary brackets cast on them for attaching the vertical wrought iron bars by which the pilot is bolted to the locomotive. These castings are obtained from the foundry, properly shaped, with all holes cored, thus eliminating laying out and fabricating the bottom frame. The back corners of the pilot are tied together by a wrought iron bar which makes the pilot base frame a triangular truss. The sawtooth arrangement of the vertical flange on the frame casting permits the bottom end of each slat to be shaped so that the flattened portion is exactly crosswise of the pilot, thus making slats on the right side of the pilot the same as those on the left side. This reduces the number of slat patterns one-half and reduces the labor of fitting the slat to the bottom frame, as it is much easier for workmen to build slats to fit flanges extending crosswise of the pilot than flanges running diagonally.

Templates have been made for each individual part of this pilot. When pilots are ordered they are ordered in quantities. Each individual piece is made to template in the quantity required. These parts are all stacked in separate racks near the assembling rack, or jig. This assembling rack, as shown in the illustration, is a frame on which all pilots are assembled. After the required number of the various pieces have been made, the main members are assembled, bolted and clamped into proper position on this rack or jig. Rivet holes are reamed and all parts are riveted together. This assembling rack, or jig, is so built that all rivets can be driven with the pilot in this frame. By the use of this jig all members are held in proper alinement, and when a pilot is completed the bolt holes of the vertical members are in proper location to fit bolt holes in the locomotive pilot beam to which the pilot is bolted when applied.

A series of holes is located in the top end of the vertical members for adjusting the pilot to the proper height above the rail to meet I. C. C. ruling on the various classes of locomotives; thus one design of pilot can be made to fit all classes of locomotives.

This design of pilot permits the use of scrap boiler tubes for vertical slats. It reduces to a minimum the laying-out work and fabrication work, also reduces to a minimum blacksmith work and permits all parts to be made in quantity lots from templates, and by building



C. & E. I. all-metal pilot ready for application to road locomotive

the pilot in quantity lots it can be economically built. This pilot has maximum strength for the amount of material used, has ample strength and rigidity for the service intended, and when applied to locomotives presents a durable and neat appearance.

NICKEL CAST IRON.—Ten of the more important features of alloy cast iron are described and their practical value illustrated by actual applications in the booklet, "Nickel Cast Iron Theory and Practice," published by the International Nickel Company, Inc., 67 Wall street, New York. The relative characteristics of plain and nickel-bearing cast iron are also discussed in this booklet.

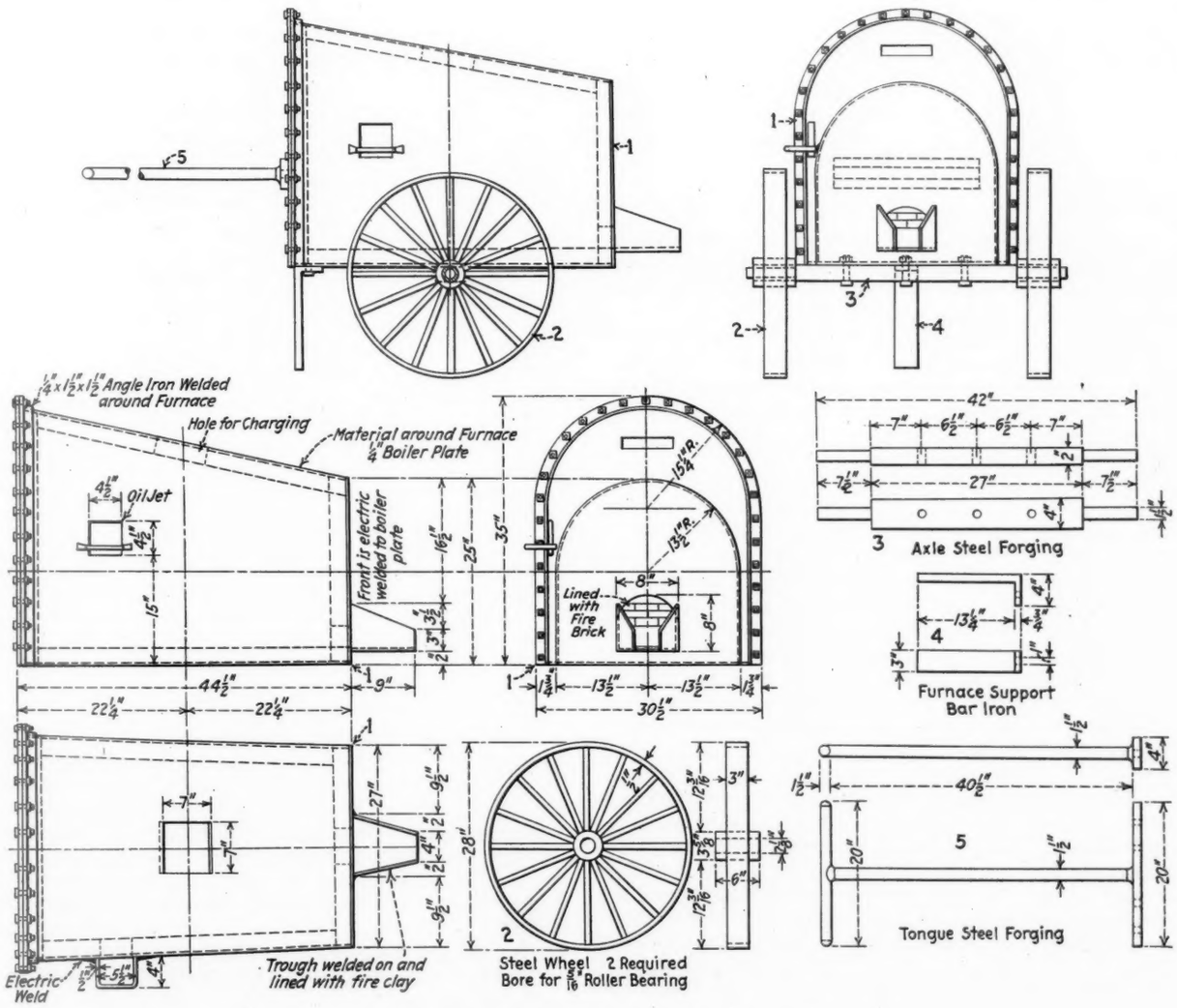
Small Portable Brass Furnace

By H. H. Henson

Machine Shop Foreman, Southern, Chattanooga, Tenn.

LACK of adequate foundry facilities often proves an inconvenience at small repair shops and engine terminals when certain brass castings are required for emergency use. This is particularly true since the practice of using steel liners on wheel centers and pouring brass on the hubs of the driving boxes has become common usage. In addition, the furnace can be used for pouring brass crosshead shoes or driving-box shoes and wedges.

The furnace is mounted on two 28-in. wheels. The details of construction are shown in the line drawing. The outside shell is made from ¼-in. boiler plate. The back shell is bolted to the furnace by ½-in. bolts so that it can be removed for relining the furnace. The front shell is electrically welded to the side pieces. The pouring trough is electrically welded in place and lined with fire clay. An oil jet for burning kerosene is located on each side of the furnace near the back end. The jets can be easily obtained from manufacturers specializing in this type of equipment.



Construction of a small portable brass furnace

THE MARTIN CIRCULATOR.—The Martin Circulator for generating rapidly moving water into steam in the bottom of the firebox of an oil-burning locomotive is described in the attractive 16-page booklet, Bulletin No. 102, issued by the Locomotive Boiler Economizer Company, Roosevelt building, Los Angeles, Cal. Diagrammatic illustrations show details of construction, pumping action, and how the tables are positioned in the bottom of the firebox to receive the radiant heat from the flame of the oil fire. The water-circulating steam-generating elements which form the bottom of the firebox comprise quadrangular shaped hollow tables with staybolted surfaces constructed of steel plate of the same thickness as the sheets of the firebox. Upon installation, they form a continuation of the water legs of the firebox.

THE INGERSOLL-RAND COMPANY has moved its Chicago office to the Daily News building, 400 W. Madison street. Fred M. Cross, manager of the pneumatic tool sales department, at Chicago, has been promoted to assistant general manager of pneumatic tool sales, with headquarters at the New York office, 11 Broadway. D. W. Zimmerman succeeds Mr. Cross as manager of pneumatic tool sales at Chicago.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

Walschaert Valve Gear with Variable Lead

GALVESTON, TEX.

TO THE EDITOR:

The endeavors to incorporate a satisfactory variable lead in the Walschaert valve gear only serves to emphasize the merits of the Stephenson link motion as a steam distributor for locomotives. The variable lead of a Walschaert valve gear is of use only when running in one direction, the valve events being considerably distorted in the opposite motion. This would seem to prohibit its use on switch engines and the majority of freight engines.

Those whose memories go back to the days when the link motion reigned supreme in America, possibly remember that 30 or more years ago a new "fad" was introduced on some railways. This consisted of setting the valves of passenger engines to give from $\frac{1}{16}$-in. to $\frac{5}{16}$-in. negative lead in full forward gear, increasing to the usual ¼-in. or $\frac{5}{16}$-in. positive lead with the link in mid-position. The advantages claimed for this were increased starting power, easier riding, reduced hot bearings, and a slight fuel economy. Today we are told that a 20 per cent increase in hauling power and a "smooth operating locomotive" have been obtained with valves set in a manner *exactly the opposite* of that just described.

When the Walschaert valve gear was brought from Europe to America its constant lead was extolled as a great blessing. This inherent characteristic necessitated fixing the lead on any given engine at the amount deemed proper for the average cut-off and speed at which the engine was destined to operate. In accordance with the theories then enjoying favor, but now discarded by the Chicago & Alton, most passenger engines were given a constant lead of ¼-in. or $\frac{5}{16}$-in. In comparing the performance of passenger locomotives of equal adhesive weight and steaming capacity, but with different valve gears, it was soon found in many instances that the engines equipped with the Walschaert gear having the above-mentioned constant lead, were sluggish in starting and accelerating. A remedy for this was devised in about 1912. It consisted of setting the valves line-and-line (or with $\frac{1}{16}$-in. lead) in full forward motion, increasing to ¼-in. or 5/16-in. in mid-gear.

This manipulation of the eccentric crank is the same method described by Charles W. Harris as now being in use on the Duluth, Missabe & Northern. Many passenger locomotives on various railways were fitted with this arrangement, and greatly improved starting and accelerating power was generally claimed. Nowadays, however, an abundance of lead seems to be required for starting the passenger trains on the Chicago & Alton.

One wishes that the writer of the article on page 697 of the December, 1928, *Railway Mechanical Engineer* had given more details concerning the valve gears on Chicago & Alton locomotives. Sufficient information may be found in that article, however, to give rise to several questions in the minds of those familiar with locomotive valve gears.

Changing only the lead of a Walschaert valve gear at any given cut-off has but a negligible effect on the duration of compression proper. The point at which compression begins and the period of pre-admission are, of course, affected. With the variable lead used on the Chicago & Alton the valve events in forward gear are much the same as those of a link motion with crossed rods, and at all cut-offs above 25 to 30 per cent pre-admission, will begin at practically the same point in the stroke. If the pre-admission afforded by a lead of ¼ in. is necessary to permit the development of a satisfactorily high initial pressure when the engine is running very slowly, how is it possible to maintain a high admission pressure in the same cylinders with the pistons traveling at say 1,200 ft. per min., the period of pre-admission remaining the same, but the port-opening during pre-admission reduced to less than one-half that found necessary at extremely low speeds? This is not intended primarily to defend the suitability of high-compression and excessive lead for locomotives operated at high speeds and short cut-offs, but rather to question the value of ¼-in. lead for engines habitually worked at long cut-offs. The writer is satisfied that a large amount of lead is a positive detriment to the prompt starting of a locomotive under heavy load, but since we are assured that Chicago & Alton engines require an abundance of lead for starting, the following question demands an answer: When it is necessary for their freight locomotives to back a heavy train, just how do they manage to start in backward gear, with a negative lead of probably ½-in.?

Most switch engines operating in this country necessarily operate much of the time in full gear, since they must start frequently and accelerate quickly, often under heavy loads. What is the practice of the Chicago & Alton in regard to setting the valves of switching locomotives. A large amount of lead being deemed necessary for starting purposes, is it recommended that these locomotives should be provided with ¼-in. lead in full gear?

The writer is rather skeptical of the merits of variable lead as applied to Walschaert valve gear by the Chicago & Alton, but if this comparatively inexpensive change in valve setting alone can raise tonnage ratings by 20 to 25 per cent, by all means let us have further and indisputable information.

WILLIAM T. HOECKER

Inquiry Regarding Variable Lead Answered

BLOOMINGTON, ILL.

TO THE EDITOR:

Quite a bit of questioning and criticism has been evolved through the article in the December, 1928, issue of the *Railway Mechanical Engineer* entitled "Getting Back to Fundamentals." The particular subject questioned was that concerning variable lead on engines with Walschaert gear.

In the first place, the sequence of events in the article leads to the erroneous impression that due to variable lead the tonnage rating on Chicago & Alton locomotives was increased 20 to 25 per cent. As any one familiar with mechanics understands, it is impossible by any change in valve setting to increase the starting power of a locomotive, especially 20 to 25 per cent, as the article conveyed.

The impression that the article should have conveyed was that, due to our shop practice, all valves are carefully gone over in the shops, and each locomotive leaves the shops with valves square and all running gear in first class shape. As stated in the article, each of the locomotives tested developed the rated tractive force at the drawbar. This is evidence in itself that the locomotives were in first class shape mechanically, due to our shop practice. As stated above, it was never intended to convey the impression that increased power was obtained through the variable lead.

As a matter of fact, there is no mention made of variable lead in the paragraph referring to the increase in tonnage rating. I might add that our new tonnage rating is based upon the maximum rated tractive power of each class of locomotive, due to the results of the dynamometer tests referred to.

Although it was not mentioned in the December, 1928, issue of the *Railway Mechanical Engineer*, we are only using variable lead on some of our passenger locomotives. None of our freight or switch power is so designed, and it is not the intention at the present time to use variable lead on any except passenger power. On our passenger locomotives with variable lead there has been a visible decrease in maintenance of running gear, boxes, shoes and wedges. The locomotives handle very smoothly and there is a marked improvement of the riding qualities. At high speeds, these locomotives roll heavy trains with little evidence of excessive internal resistance.

Up to the present time no information is available for comparison of efficiency with other locomotives of similar proportions. However, it is the intention at some time in the future to conduct accurate tests to determine the increase in efficiency, if any, of our locomotives with variable lead over similar locomotives with constant lead. The locomotives with variable lead have, however, shown themselves to be just as economical under operating conditions with reference to fuel performance, and at the same time have proved their superiority from a maintenance standpoint.

Elaborating a little further on our method of obtaining variable lead, the combination lever is first proportioned for 1/16-in. constant lead. Then the position of the eccentric pin is advanced sufficiently on the eccentric circle to produce the desired variation in the lead in forward motion. It is true that the lead is reversed in back-up motion, and for this reason we do not consider it would be wise to change our freight and switch power to variable lead.

As previously stated, I have been called upon to answer numerous questions and criticisms, principally because the impression was erroneously conveyed that we were able to develop 20 to 25 per cent more power with variable lead. However, I want to take this opportunity to correct this misunderstanding and to state that we feel we have had sufficient improvement in our locomotives with variable lead to warrant changing various other passenger engines as they pass through the shops.

C. M. HOUSE,
SUPERINTENDENT OF MOTIVE POWER AND EQUIPMENT, CHICAGO & ALTON

A Comment on Rule 66

MILWAUKEE, WIS.

TO THE EDITOR:

Referring to James W. McDonnell's article, "Is Rule 66 Accomplishing Its Intended Purpose?", which appeared on page 507 of your August, 1929, issue, is it not too early to ask whether the rule is accomplishing its intended purpose, when it is not yet in effect?

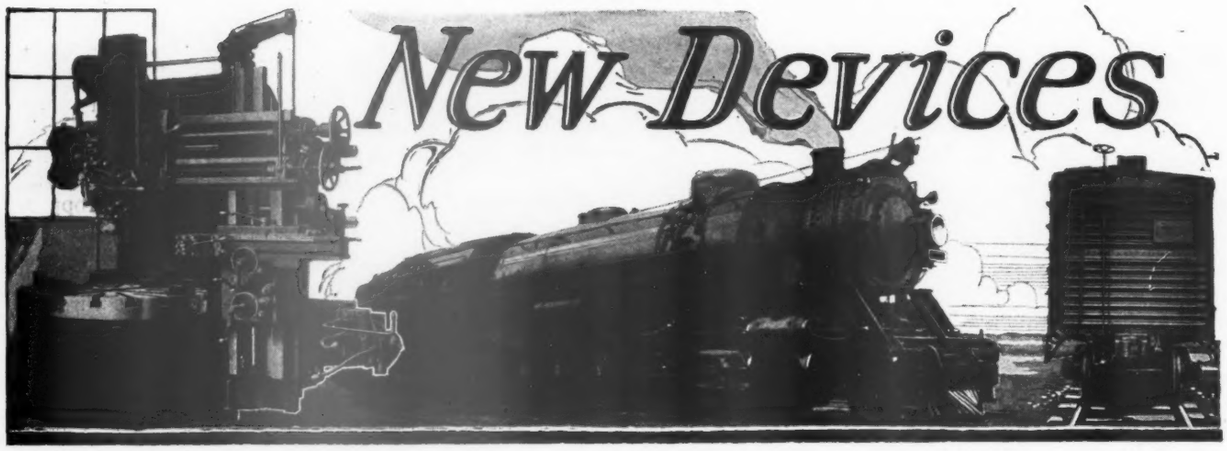
The rule was amended at the convention this year to provide that if a car is on the repair track for any purpose whatsoever and it contains no repacking date, or if the date is over nine months old, the repacking may be done at the car owner's expense. Discussion regarding why the car was shopped will allow the owner to determine whether it was shopped solely for repacking which would not be allowed under the rule as now written. It is true that the annual air brake cleaning is performed at freight houses and other places where repacking of boxes would not be practical, but I think Mr. McDonnell will concede that a freight car will not, as a rule, remain continuously away from repair tracks for such periods as he mentions. The present Rule 66 is not the same as the rule of some eight years ago, as a comparison will show. For one thing, the new rule prohibits repacking in a train yard.

As to the work being done contrary to the rule, I, for one, am willing to trust to the usual common sense of the Arbitration Committee to provide necessary safeguards against this. Supplement No. 1 issued a few weeks ago states on page 10 that no further extension will be granted in the effective date of the rule. Even though the effective date has been repeatedly extended, no doubt because a special committee has been working on modern standard specifications, the very fact that the rule has been in the book but not effective, has done much good, as is evidenced by the condition of journal-box packing generally. I believe Mr. McDonnell will agree with this.

The rule as written looks good to me—far better than no rule at all. No doubt it will need amendment, but that will come after its weaknesses develop through actual operation. Experience may show that better attention to the dust guard or dust-guard cap is necessary, or it may show that the car should be shopped solely for repacking, or it may show many things. Let us give it a chance and let us have faith that it will be amended as needed.

In the meantime, let us all get behind it with our whole-hearted co-operation.

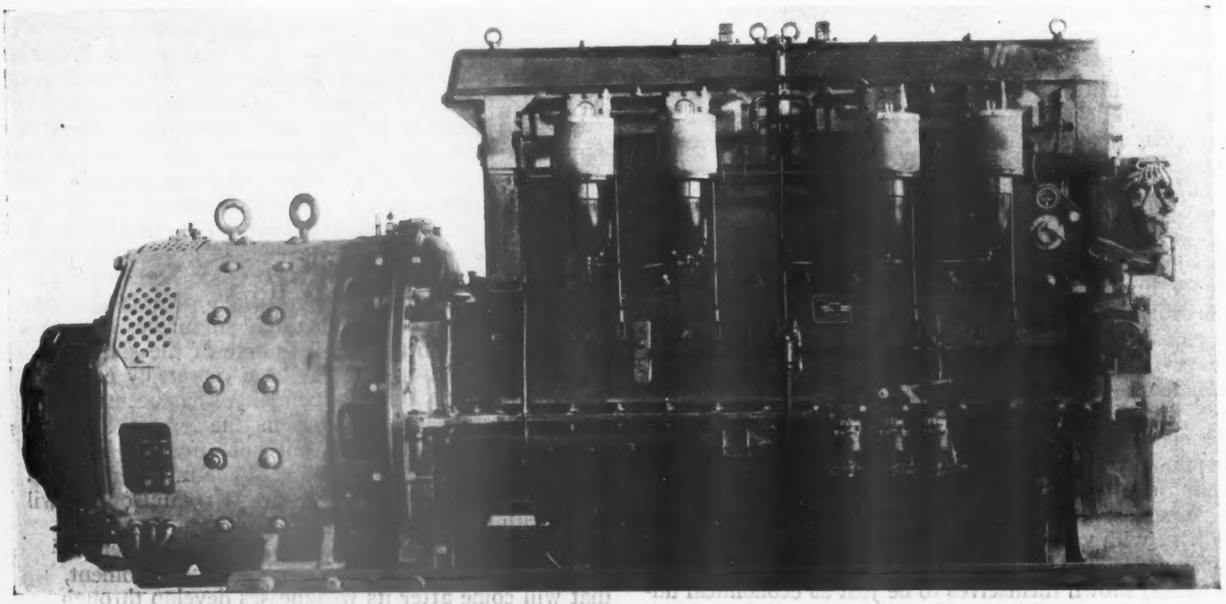
J. HEMSEY,
GENERAL CAR FOREMAN, CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC.



Hall-Scott 350-Hp. Gasoline Engines

THE 350-hp. Hall-Scott engines used in recent Brill gas-electric rail cars are designed for exceptional efficiency and incorporate numerous features developed as a result of the extensive engine-building experience of the Hall-Scott Motor Car Company, Berkeley, Cal., division of the American Car & Foundry Motors Company. The preliminary dynamometer tests showed a fuel consumption of .55 lb. per brake hp. hr. through the practical operating range, and actual service tests are said to have shown a car performance of 160 to 195 ton-miles per gal. with a low grade fuel. This high economy is achieved with a relatively low compression ratio, the gage pressure being 72 lb. The overall efficiency is due partly to an unusually high mechanical efficiency which is achieved by holding down the friction losses in the accessory drive mechanism by the use of ball bearings, the complete counterbalancing of the crankshaft, also equipped with a torsional vibration damper, and the holding down of the inertia forces in reciprocating parts by the use of light weight alloy pistons, and chrome nickel steel connecting rods. The thermal efficiency also is high, the temperatures of both the water jacket and the intake manifolds being under the direct control of the engineman and the engine being operated with high cylinder head temperature of the incoming gas.

The Hall-Scott engine is designed to supply ample power when used in dual installations to propel heavy cars at high speeds. Cases are on record in which moderately fast schedules have been maintained by a single engine while the other engine was undergoing repairs. The compactness of the power plant with the new engine permits the use of a smaller engine room, thus leaving a larger percentage of the total car space avail-

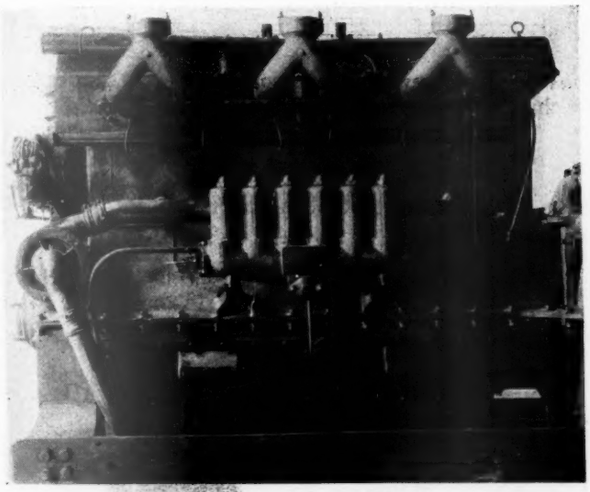


Hall-Scott 350-hp. engine directly connected to a heavy-duty direct-current generator

able for pay load purposes. The light weight of the dual engine installation is designed to make possible the use of equipment developing 700 hp. without exceeding the rated capacity of standard M. C. B. four-wheel trucks. The six cylinders in each engine are fed through four carburetors, manifolding being designed in such a manner that a uniform gas flow is maintained to all cylinders, while volumetric efficiency at operating speeds is promoted by the use of long branch manifolds built in line with the intake passages in the head so that the ramming effect of the moving column of gas keeps on filling the cylinder after the piston is beyond bottom dead center.

The general design of this engine follows the customary Hall-Scott practice with overhead valves and camshaft and machined dome-type combustion chambers. The six cylinders with 7½ in. bore and 9 in. stroke have a piston displacement of 2,385.6 cu. in. The engine is governed at 1,100 r. p. m., at which speed it develops in excess of the rated 350 hp. At the governed speed the piston speed is 1,650 ft. per min. Two inlet and two exhaust valves are used in each cylinder to lower the weight and facilitate cooling of the valves.

Multiple ignition is supplied from two high tension magnetos driven from the same shaft through a helical gear by the main accessory drive shaft. The cylinder head is cast in two interchangeable sections. Each section has its own camshaft and these are joined at the center of the engine by means of a Morse type coupling.



The exhaust manifold side of the Hall-Scott 350-hp. gas engine

The cylinder head castings are made from a special chrome nickel cast iron mixture poured from an electric furnace at a much higher temperature than ordinary cast iron. This gives an extremely fine grained mixture, readily machineable, about 30 per cent harder than cast iron, and having the peculiar characteristic of being able to resist the pounding of valves at temperatures which would cause them to bed into cast iron or semi-steel.

The same mixture is used for the cylinders, which are made up as separate liners inserted in the main block casting. These liners are sealed at the top by the overlapping cylinder-head gasket, which is protected from burning by an extension of the cylinder liners which project above the shoulders and pilot into the combustion chamber. The cylinder barrels are completely machined all over the outside for uniformity of wall thickness and are ground to exact dimensions over the areas where the water seals are provided at the top and bottom. It is claimed by manufacturers that cylinders made of this material have more than double the life of semi-steel.

In order to achieve light weight without sacrificing strength, it has been necessary to use considerable quantities of light weight metal. Both crank cases, the bell housing, the intake manifolds, the rockerarm cover and several other minor parts are made of aluminum alloy. High tensile steel alloys have been used in the crankshaft, main accessory drive shaft, connecting rods and camshaft to lighten the weight without sacrificing the necessary factor of safety. The general principle of using heat-treated alloy steels for all parts subject to stress or to stress and wear, and using case-hardened steel for all parts subject only to wear, has been very closely followed in this engine. All gears are of high nickel alloy steel heat-treated, case-hardened and ground, the teeth being in all cases of either the helical or spiral bevel type for silence, strength and long wear. The parts are further protected from wear by a lubrication system which is under close thermal control, the oil supply coming from a water jacketed sump through which the water is drawn from the radiator before being pumped to the cylinder block and head. Besides being maintained at a relatively constant temperature, the oil is filtered through a battery of Hall-Winslow filters before passing to the bearings, and a large amount of oil is pumped over the heated cylinder heads where any motor fuel passing down into the oil through the piston rings is distilled off. It is claimed that in operating these engines on gasoline fuel, the viscosity of the lubricating oil is held practically constant on account of this distillation feature.

Five breathers are provided on the engine to give thorough circulation of air and allow the vaporized gasoline to escape from the engine head and crankcases.

The generator frame is bolted directly to the bell housing and is driven through a flexible coupling consisting of three thermoid discs bolted on spiders attached, respectively, to the engine flywheel and the generator. The spider from the flywheel arches over the discs so that its point of attachment is on the same side as the generator spider, all coupling bolts being tightened from the front. This feature holds the discs in alignment instead of throwing them into a scalloped shape as the adjustments are made, and is said materially to increase the life of the discs.

* * *

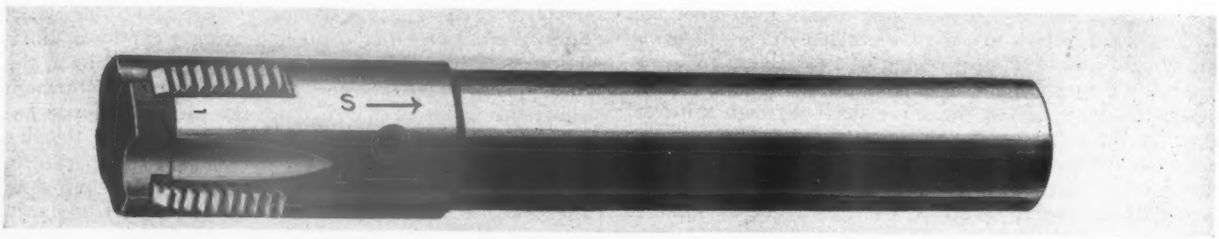
Stock car built for the Chicago, Milwaukee, St. Paul & Pacific by the Ryan Car Company

Four New Geometric Products

THE Geometric Tool Company, New Haven, Conn., has recently placed on the market four products entirely new in construction and design.

One of the principal features of the Class SJ solid adjustable tap is that all working parts, even the size adjustment mechanism, are located in the nose or front end of the tool. Thus that portion of the tool carrying the chasers is the largest diameter of the tap, which allows the tap to cut threads to any required depth, the depth of tapping being limited only by factors outside of the tool, such as overhang, method of holding the tap, etc.

The tap is compact so that it will swing in a small space. It is short thus avoiding overhang and making it possible to swing it on special machines having a limited clearance. Because of its compactness and its positive and accurate size adjustment, this tool can be used to special advantage on chucking machine and similar equipment and for sizing either by machine or by hand.



Class SJ solid adjustable tap

The Class R receding chaser tap was designed for tapping taper threads where the depth is great, the taper steep and the material tough. The tap is a complete unit in itself. On the bigger sizes no complicated outside tripping mechanism is required. All working parts are fully enclosed.

In operation the tap advances onto the work as a jam-cut tool then, after the chasers have taken hold, an adjustable taper bar working through a pawl onto the chaser plunger causes the chasers to recede as they advance into the work. At a predetermined point the chasers collapse and the tool may be backed out from the work at any desired speed. All of these working parts are enclosed out of the way of all chips and dirt.

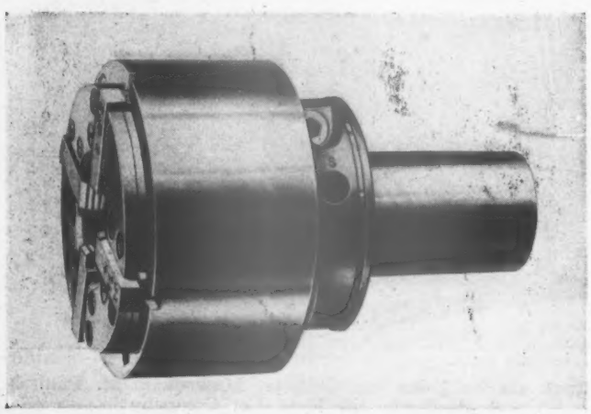
Like the Class S collapsible tap, the tool has a universal application in that it may be quickly and readily converted in the following three distinct types of tools without the purchase of additional parts.

Stationary type, plate trip—Contact with the trip plate recedes and collapses the tap, the resetting being done by a convenient handle. This type is used on turret lathes and similar machines.

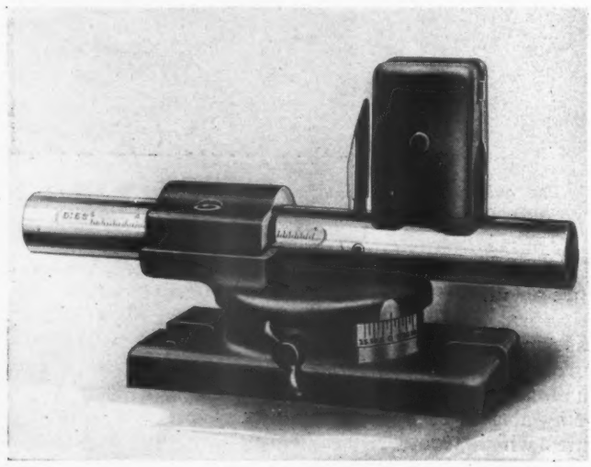
Rotary type, plate trip—The tripping action is like the above; the resetting done by a fork contacting with the back face of the closing sleeve. The handle is removed. Such a tool is used on drill presses, chucking machines, etc.

Rotary type, sleeve trip—The trip plate and handle are removed; this type of tap is tripped and reset by a fork or yoke fitting into the groove of the closing sleeve. This type of tool is frequently used on automatic screw machines, threading machines, etc.

On chucking machines and on many single-purpose special machines there is still a demand for a solid adjustable die head. To meet this demand Geometric has designed a new tool, designated as the Style KJ yet one which employs the same chasers, size for size, as the Style KD rotary and Style KH hand die heads.



Geometric Style R & J solid adjustable die head



Geometric universal chaser-grinder fixture

One of the features of the tool is a size-adjustment mechanism which is so readily accessible that adjustment can be made without removing the tool from its

spindle or holder, yet which is so securely locked in place that the die head will not change its size even when suddenly and repeatedly reversed at high speeds.

Chasers may be quickly replaced by pressing down a thumb release on the back of the tool and pulling the chasers out with the fingers. These same chasers while cutting are not only rigidly supported along the sides and bottom with a supplementary support from the face plate on top, but they are also rigidly backed up by a solid wall of metal directly behind the cutting point.

Milled chasers, tapped or hobbed die-head chasers, collapsing tap chasers, all may be reground with equal facility on the new Geometric chaser-grinding fixture, even though this means a flat chamfer, a concave chamfer and a convex chamfer, respectively. The cutting face of all these different types of chasers may also be reground on the same fixture giving the chasers the angle of hook or snub that is required by the work to be threaded.

The fixture can be used on any universal surface grinder or similar machine.

Speedmatic Electric Hand Saw

THE Speedmatic hand saw recently placed on the market by the Porter-Cable Machine Company, Syracuse, N. Y., has no gears as the blade is mounted directly on the motor armature, which runs on two precision ball bearings of the unit type with a dust seal. These bearings have a load capacity of 100 lb. and are lubricated from two grease cups.

The guard has a capacity for an 8-in. blade which will cut a maximum vertical depth of 2¼ in., or 2¾ in. at a 45-deg. angle. The guard is cut away at the

Speedmatic electric hand saw

point where the blade enters the wood. This permits accurate cutting as the blade is easily visible to the machine operator.

The base is made of duralumin and measures 10½ in. by 5 in. It is fastened to a segment, which in turn is dovetailed and gibbed onto the motor housing. Adjustment for depth or angle is obtained by a turn of a thumb screw in both cases, each adjustment being independent of each other. There is a 1¼-in. range of depth adjustment. An 8-in. blade cuts from 1 in. to 2¼-in. in depth, a 6-in. blade from zero to 1¼-in., thus providing ample range for cutting out flooring, dadoing, slotting, etc. Any angle up to 45 deg. may be cut and at this angle an 8-in. blade cuts 2¾-in. into the wood. This ½-in. increase in cut is due to the pivoting of the base which allows the motor and blade to tilt closer to the wood. A ½-in. round shaft allows for the use of standard saws and dado cutters. Dados recommended are 5 in. in diameter and up to ½ in. in width with a ¾-in. maximum depth of cut in the material.

The saw blade is fully guarded at all times, even when cutting at an angle. This guard consists of two parts, the upper part being fixed and fastened to the frame while the guard covering the lower part of blade is hinged to the fixed guard and held in position by a small coil spring, insuring constant protection to the operator.

The saw is powered by a General Electric universal motor of ½-hp. rating. Because it is universal, it can be operated on any alternating current of the correct voltage of 25 to 60 cycles or on direct current. The motor has a maximum output of 525 watts, ⅝-hp. This power drives the saw blade at 10,000 r.p.m. (free speed) assuring a fast, clean cut, making finish planing hardly necessary. The housing is constructed to make the motor easily accessible, the brushes and commutator may be inspected and cleaned as they are in full view through the air intake. The handle is a pistol grip easily grasped and with the 10-amp. switch readily controlled by the index finger. This switch must be held while the saw is in operation and automatically shuts off when released. The electrical cable leads out of the end of the handle keeping it free from the work and eliminating any possibility of cutting the cable when the jaw is being used.

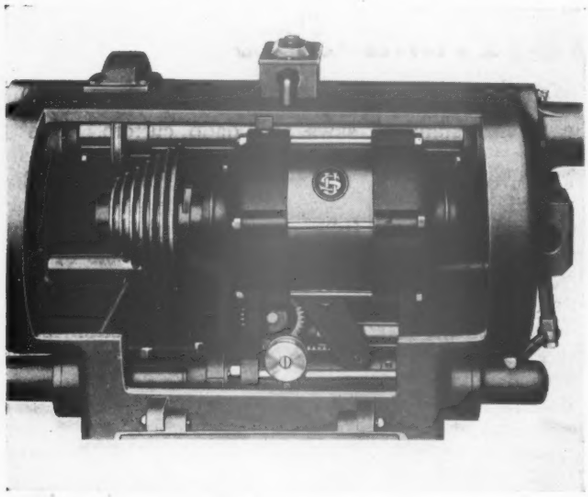
A unique system of cooling is employed. Instead of the motor fan being inside the motor housing as is the usual arrangement, the fan is built onto that part of the armature shaft which is inside the blade guard. Thus the fan can not get loose and injure the motor windings. Air is drawn in by the fan through the intake at the commutator end of the motor housing, passes around the motor and is exhausted inside the saw guard. This blows the sawdust out and away from the operator, thus keeping the work clean and preventing the guard from becoming clogged and inoperative.

GLOBE SEAMLESS STEEL TUBES.—A well-illustrated, 13-page booklet recently issued by the Globe Steel Tube Company, 1345 Burnham street, Milwaukee, Wis., outlines in a comprehensive and interesting way the manufacture of Globe seamless steel tubes. Considerable space is devoted both to the equipment and production processes, from the piercing of the high-grade open-hearth billets to the testing of the finished seamless tubes. Much of the tubing described in this booklet is used in locomotive construction, but it also has many applications in automotive, marine, electrical and constructional work.

Buffer with a Wide Range of Speeds

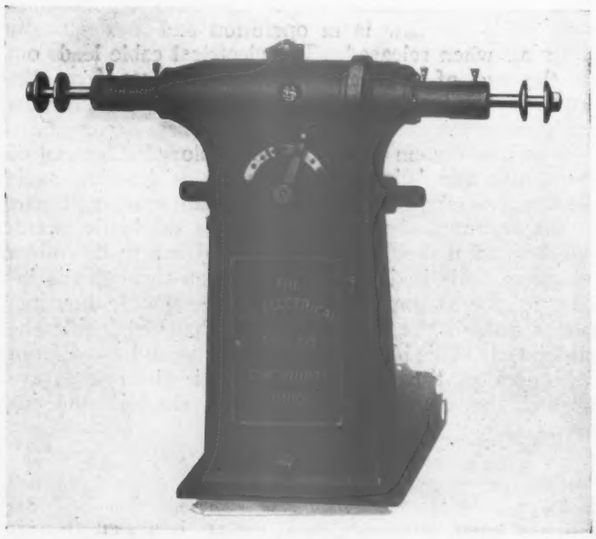
THE United States Electrical Tool Company, Cincinnati, Ohio, has placed a machine on the market which has been developed to meet such condition. It is called the U. S. Multispeed buffer and polisher.

Transmitting the different speeds is done by a Gibbs vee-disc transmission of graphitized Micarta. A cone or series of different sized discs revolves on the motor



Top view showing the Gibbs vee-disc transmission of graphitized micarta

spindle. Any one of these (depending on the speed desired) can be quickly inserted into a stationary metal vee-disc or sheave mounted on the wheel spindle by releasing the cone with a foot pedal and moving it into



The U. S. Multispeed buffer and polisher

the desired position by means of a hand lever on the front of the machine. The motor and disc cone are mounted on a rocker arm so that they may be easily moved along the mounting parallel with the wheel spindle. Changes in speed are made only when the motor and wheels are not in motion. These buffers provide a range of four speeds from 2,000 to 3,000 r.p.m., but additional speeds can be added if desired.

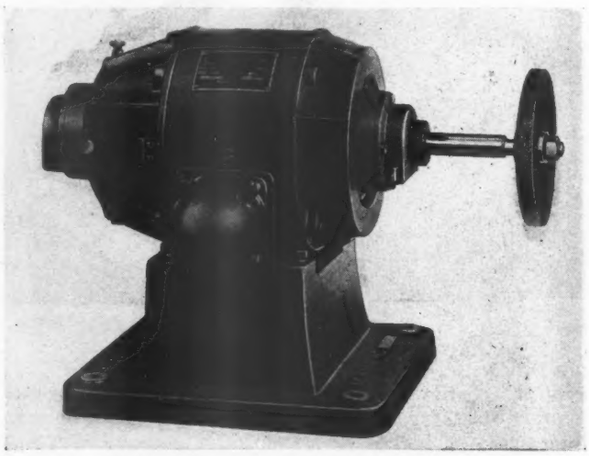
The buffer consists of a heavy one-piece chrome manganese-steel wheel spindle supported on four heavy-duty SKF ball bearings which are enclosed by a labyrinth seal in dust-tight grease compartments. The motor is built for continuous service. It is of 40 deg. rating, with momentary overload capacity, and operates at 3,600 r.p.m.

Control is by push button mounted at the top within easy reach of the operator. The control has overload protection and no-voltage release. The general design and the proper distribution of metal in this machine give balance and freedom from vibration.

This buffer is furnished in four sizes: 1, 2, 3, and 5 hp., 220, 440 and 550 volts, 2- or 3-phase, 25-40-50- and 60-cycle alternating current.

Self-Contained Tap Grinder

THE J. G. Blount Company, Everett, Mass., has developed a machine for tap grinding which is driven by a specially designed 1¼-hp. Westinghouse type SK motor. The machine is used for the grinding of tap flutes by the use of a taper arbor on the end of a spindle, using various sizes of grinding wheels. For the grinding of small taps, wheels of small diameter and width are used, while, on larger taps, grinding wheels up to 6 in. in diameter and one half to three fourths inch wide are employed.

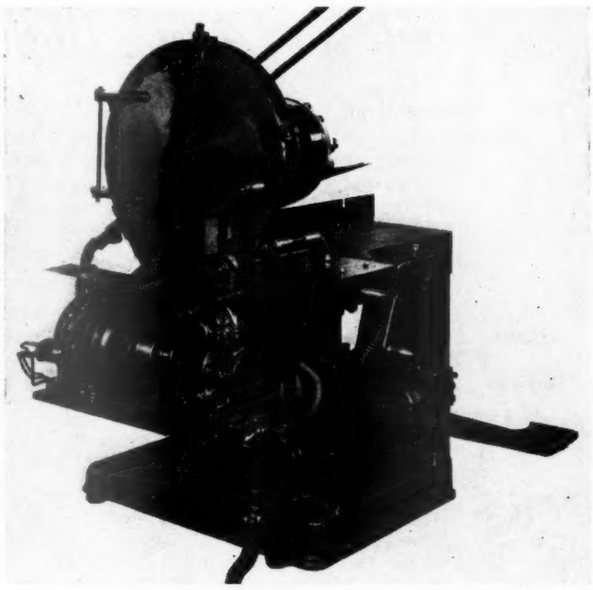


Blount tap grinder driven by a 1¼-hp. Westinghouse motor

These grinders are self-contained, being driven by a special direct-connected totally enclosed, ball-bearing motor with a speed range of 4,000 to 7,000 r.p.m. The motor is controlled by a field rheostat so that any grinding speed may be obtained within the speed range. A smooth finish can be obtained by the inherently close speed regulation of the drive.

Rotating Attachment for Friction Saw

A ROTATING attachment for the Ryerson No. 0 friction saw has been developed by Joseph T. Ryerson & Son, Inc., Chicago, which practically eliminates the burr in cutting round tubing pipe, and bar stock.



Stock-rotating attachment increases the capacity of Ryerson friction saw

The rotating attachment increases the capacity and at the same time reduces the load on the saw motor. It consists of a special work table on which are mounted supporting rollers for holding the stock in position while being cut.

One set of these rollers is driven by the direct gearing from a fractional-horsepower motor through a speed reduction unit and gearing. A second set of rolls is mounted on an adjustable bracket which may be moved in or out to accommodate various sizes of stock. A third roller is brought down on top of the stock by an air cylinder arrangement which holds the stock firmly in position while it is being rotated. This attachment provides rotation of constant peripheral velocity to any size of round stock which may be placed in the machine and eliminates chucking and change speed gears. The machine may easily be changed for cutting structural shapes by dropping the drive rollers and replacing the adjustable bracket with a work-table plate. The main motor is a 10-hp., 3,600-r.p.m. unit. The new blade is of the standard hobbed type and is 24½ in. in diameter.

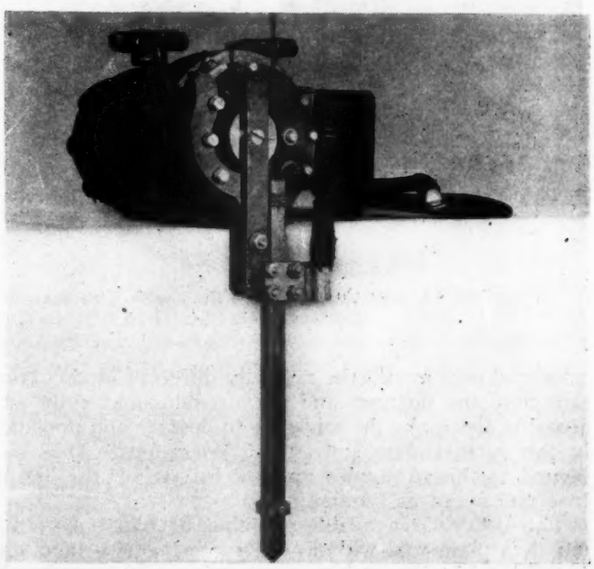
Non-ferrous metals such as aluminum, brass, bronze, zinc, and babbitt, which have heretofore required a slow-speed cut-off saw, may now be handled on a high-speed friction saw. A special blade with sharp inserted teeth makes this possible, increasing the cutting speed nearly 100 per cent for this type of material at the same time maintaining the same quality of cut. This machine is the same as the standard No. 0 friction saw except that it has a positive screw feed which replaces the hand-lever and foot-treadle feed, and a more powerful, higher-speed motor. The blade is 24 in. in diameter and is cooled with water through the same type of adjustable water head as on the standard No. 0 saw.

Westinghouse Automatic Welding Outfit

THE Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has brought out a redesigned automatic welding outfit which it has designated the Weldomatic. The Weldomatic equipment is complete with electrode-feeding device, control cabinet and operator's panel. It is designed to operate with equal satisfaction from either Westinghouse variable-voltage or constant-voltage welding motor-generator sets.

It automatically strikes and holds an arc between an electrode and the work to be welded without the aid of an operator other than to press the starting button. The feeding device is of a compact design which permits its ready application to work handling tools. The drive motor is mounted in a cylindrical frame which supports the nozzle assembly. The nozzle has adjustments for movement in two planes, and the nozzle assembly can be reversed easily to be either a right or a left assembly.

The compact design is obtained by a new method of automatic arc control. This method permits the elimination of all clutches, relays, springs, etc., which require delicate adjustment and frequent renewal of wearing parts to insure satisfactory operation. The control units are mounted in a cabinet which may be conveniently located with respect to the head and operator's



Simplified Weldomatic head showing the electrode-feeding device and cylindrical frame enclosing the driving motor

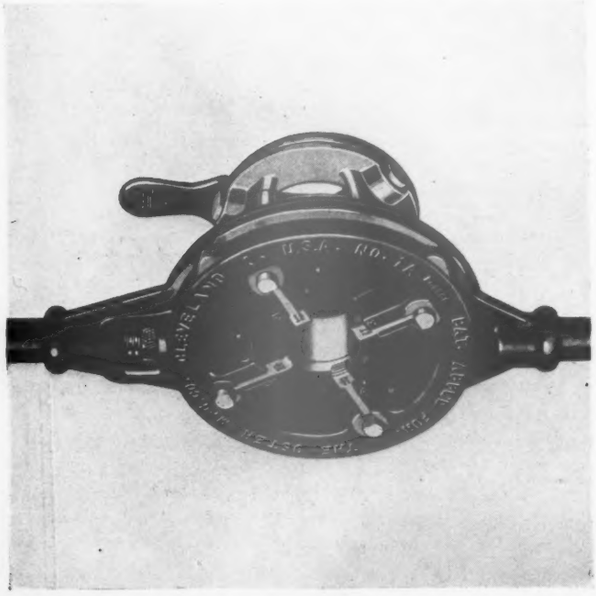
panel. A small motor-generator set in the cabinet automatically controls the head motor to change its speed and the direction of electrode feed as required by arc conditions. By means of this control, positive striking characteristics unusual sensitivity of response to arc conditions, and a rate of electrode feed exactly equal to the electrode consumption is obtained. During the welding operation the control motor generator set is the only moving part in the control system.

The operator's panel has a rugged start-and-stop pushbutton station with large buttons to facilitate its operation with gloved hands. A rheostat controls the arc voltage, which is recorded on a voltmeter, over a wide range. A switch on the panel also permits the operator to reverse the direction of the headmotor to retract the electrode from the work under power.

Pipe Threader with Universal Guides

A *PIPE* threader which incorporates, among other improved construction features, universal guides that automatically center the pipe, has been placed on the market by the Oster Manufacturing Company, Cleveland, Ohio.

The new tool, designated as the Leader, threads and cuts pipe from 1 in. to 2 in. It is claimed that the



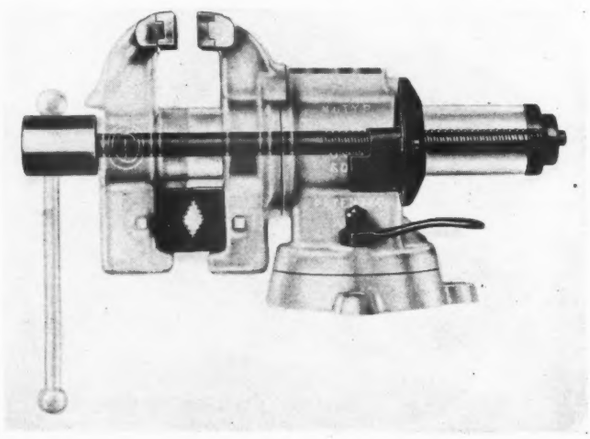
Type No. 1A pipe threader furnished with a ratchet attachment

universal pipe guides the radically different ratchet construction, the floating stud arrangement and fully adjustable dies make the tool easy to operate and unusually fast in threading and cutting operations. It is designed to thread nipples up to 2 in. with the same ease and speed as regular pipe.

The Leader is available in either of two types—the No. 1, a plain tool without the ratchet device, and the No. 1A with the ratchet construction. The ratchet is built directly around the dies where the strain of the pull ordinarily comes and more freedom of action is permitted when working close to a wall or in otherwise cramped quarters. On the ratchet-type tool, the ratchet can be set for forward or reverse or locked for use as a plain tool by turning of a control wheel.

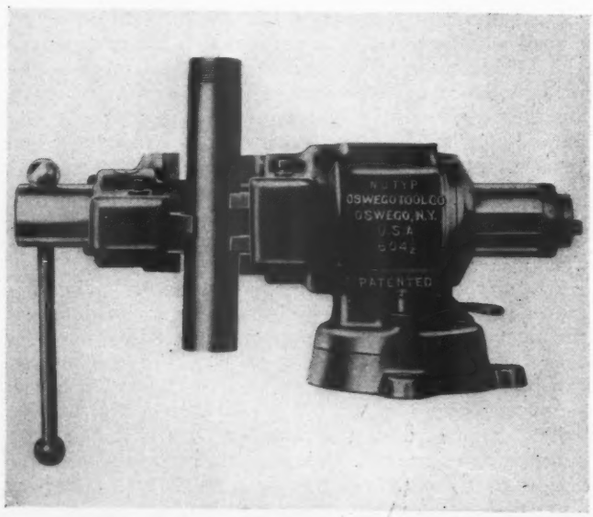
Bench Vise Adjustable to Any Angle

THE Oswego Tool Company, Oswego, N. Y., has placed on the market a sturdy bench vise, which has been designated as the Nutyp, the clamping jaws of which can be adjusted to any angle in relation to the



Phantom view of the Oswego bench vise

horizontal center line of the vise. The body of the vise is in the form of a cylinder, through the center of which passes the main screw on the end of which is an adjustable collar nut. The vise jaws rotate around the main screw. Proper tension on the rotating jaws is set up by two machine screws on the main nut. The horizontal swivel is locked when the jaws grip the work.



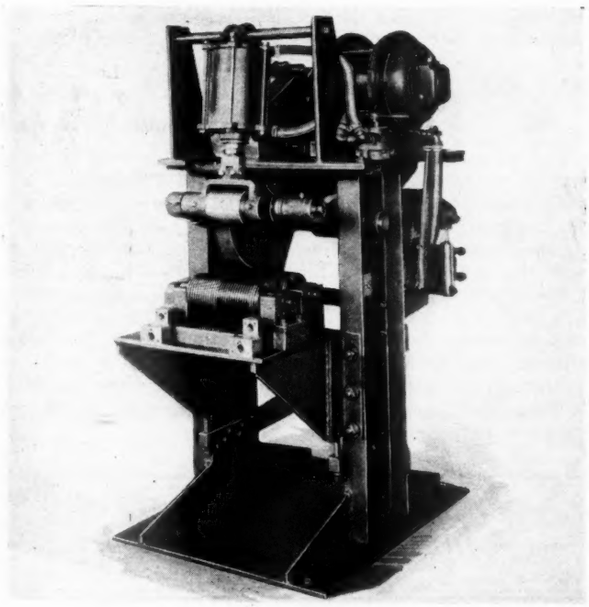
Pipe held in a vertical position for threading

The pipe jaws and vise jaws are independent of each other.

Since the horizontal cylinder swivel, in combination with the swivel base, permits holding the work at any desired angle, it is possible to hold pipe in a vertical position for threading. The top of the cylinder is flattened for use as an anvil.

Flue Cutting and Polishing Machine

JOSEPH T. RYERSON & SON, INC., Chicago, has developed a flue cutter and polishing machine for locomotive flue shops where boiler tubes and flues are welded by the electric butt-weld method. This machine combines the two operations of cutting off the fag



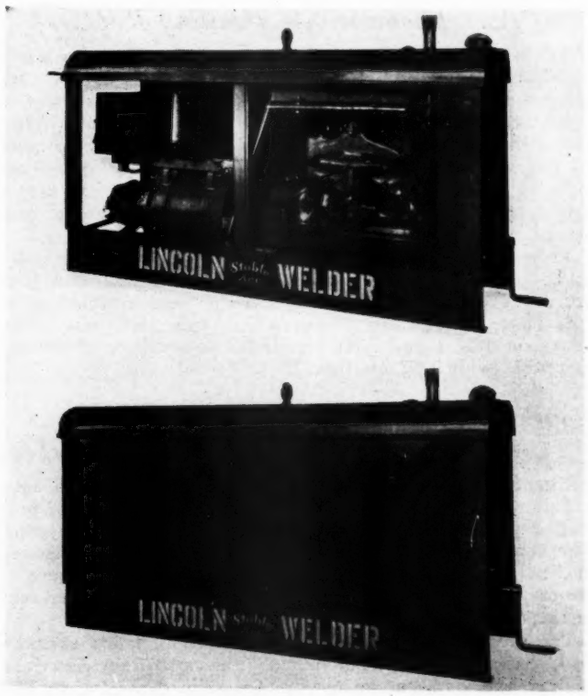
Ryerson flue-cutting and polishing machine

end of the tube or flue and polishing the end which is to be placed in the welder. The machine has a welded steel frame on which is mounted a bracket with two large spiral rollers to hold the tube. When a tube is placed in position an everhead drive roller which is operated by an air cylinder is brought down on the tube, rotating it over the two spiral rollers. This causes a slight scraping action against the tube, removing all the scale and exposing the bare metal. A separately operated cut-off attachment is mounted on the machine and is operated by an air cylinder arranged with an oil dash pot to provide slow movement of the arm. A cut-off disc at the end of this arm is brought down on the tube which is being rotated and cuts off the fag end of the tube while it is being polished. Both cylinders are operated from one air valve which allows the drive roller to come down first on the tube, to be followed by the cut-off disc. The machine is driven by a 5-hp. 1,200-r.p.m. motor and will handle tubes from 1½ in. to 6 in. in diameter. It is said that the machine will effectively polish and cut off a flue in less than one minute.

Lincoln Gas-Engine-Driven Welder

THE Lincoln Electric Company, Cleveland, Ohio, recently placed on the market a welder driven by a gas engine for use where electric power is not available. The welder is of 200 amperes N.E.M.A. rating and is driven by a four-cylinder Waukesha engine, operating at 1,500 r.p.m.

An idling device is incorporated, which automatically reduces the speed of the gas engine when welding op-



Two views of the Lincoln engine-driven welder

erations cease and automatically accelerates the engine to proper speed as soon as welding is started. It is estimated by the builder that this device will reduce fuel consumption approximately 25 per cent as well as considerably reduce wear in the welder which will increase the life of the equipment.

Another feature of the welder is the complete protection afforded the machinery by the welded steel canopy which totally encloses the outfit. Unified control is also incorporated in the new model. The operating controls are enclosed in a ventilated steel cabinet.

VALVES AND FITTINGS.—The new catalogue issued by the Reading Steel Casting Company, Inc., Bridgeport, Conn., covers Pratt & Cady iron and bronze valves and asbestos-packed cocks and Reading cast steel valves and fittings. It includes valuable information on the care and use of valves; floor stand and chain wheel applications; motor operator applications; drilling tables for iron, bronze and steel flanges, and a general section of useful information for the engineer, steamfitter and plumber.

News of the Month

THE NASHVILLE, CHATTANOOGA & ST. LOUIS is coloring the locomotive hauling the Dixie Flyer dark maroon. This color is used on the tender, cab, jacket, cylinder casings, headlight, stack and bell bracket. The front end of the smoke box is being finished with a light graphite paint. The wheels and other parts of the locomotive beneath the running board are finished in black.

Fewer Locomotives Awaiting Repairs

FEWER locomotives were in need of repair on the Class I railroads of the United States on July 1 than at any time since the railroads began the compilation of these reports in 1920, the Car Service Division of the American Railway Association has announced. The number was 7,453, or 13 per cent of the number on line. This was a reduction of 350 locomotives, or 4.5 per cent as compared with the best previous record established on June 1, at which time there were 7,803 locomotives, or 13.6 per cent, awaiting repairs.

Locomotives in need of classified repairs on July 1 totaled 4,152, or 7.2 per cent, a reduction of 305 compared with June 15, while 3,301, or 5.8 per cent, were in need of running repairs, a decrease of 207 compared with June 15. Class I railroads on July 1 had 5,411 serviceable locomotives in storage compared with 5,592 on June 15.

Southern Pacific Lounge Cars to Shed Heat

THE SOUTHERN PACIFIC is using aluminum paint and antiactinic window glass in its new lounge cars as a means of protecting passengers from summer heat on cross-country trips. The aluminum paint is employed because of its heat-reflecting quality. It is expected to reduce materially the temperature of the car interior by keeping out from 20 per cent to 25 per cent of the sun's heat.

The special window glass, which "admits light but excludes heat," has not been used heretofore in the cars of any American railway, but has been employed on trains in tropical India and Africa. This English-made glass, calorex, cuts off about 80 per cent of the heat from the sun's rays while transmitting about 65 per cent of the light.

Automatic Train Pipe Connectors To Be Tested

ON SEPTEMBER 19 a conference was held in the office of the director of the Bureau of Safety of the Interstate Commerce Commission at Washington for the purpose of determining a method of procedure and arriving at an agreement concerning tests of automatic train pipe connectors which are proposed to be made by the American Railway Association as a result of a complaint filed with the Interstate Commerce Commission by the train service brotherhoods. The American Railway Association has appropriated $100,000 to start the work. The facilities at Purdue University are available for carrying on the laboratory tests, which will be made under the direction of Harley S. Johnson, director of research of the American Railway Association.

Present at the conference were representatives of the Bureau of Safety, the American Railway Association, and the brotherhoods. It was decided that the investigation would be carried on by the American Railway Association in co-operation with the Bureau of Safety and representatives of the brotherhoods; that the detailed conduct of the investigation would be under the direction of Mr. Johnson, and that the association will purchase the required number of the various devices selected for test and submit such devices to laboratory tests to determine which, if any, show sufficient merit to warrant road tests under actual service conditions, the tests to be begun after all devices purchased have been received at the laboratory. Following the completion of the laboratory tests, the devices showing sufficient merit will be submitted to road tests under actual service conditions.

The expenses of both the director of research and his staff and any expenses that may be incurred through purchase of material or conducting the tests will be borne by the railroads and cleared through the American Railway Association.

New York Central Buys 35 Oil-Electric Switchers

THE NEW YORK CENTRAL has ordered 35 oil-electric switching locomotives for use in its West Side yards in New York City. This is the largest order [more than $4,000,000] ever placed in this country for oil-electric power. These locomotives will be equipped with 300-hp. Ingersoll-Rand oil engines and 200-kw. generators of the General Electric Company. These locomotives, which will be assembled by the American Locomotive Company, may be operated by power furnished by an Exide storage battery of 219 cells weighing 17 tons; from the storage batteries and engine generator combined; from the third rail, or from an overhead collector. The fuel tanks have a capacity of 200 gal., which is sufficient to operate the engine at full load for about 10 hours.

Clubs and Associations

C. T. WINKLESS, fuel agent of the Chicago, Rock Island & Pacific, with headquarters at Chicago, has been appointed secretary-treasurer of the International Railway Fuel Association, succeeding L. G. Plant, president of the Railway Engineering Equipment Company, Chicago, who has resigned.

Third National Fuels Meeting

The third National Fuels Meeting, under the auspices of the Philadelphia Section of the Fuels Division, American Society of Mechanical Engineers, will be held at Philadelphia, Pa., October 7 to 10. The program is arranged for engineers interested in the production, use and conservation of fuels and will include papers on general subjects, such as economics of reclamation of anthracite culm, cleaning of anthracite, low temperature carbonization, etc., also papers on power plant, industrial and domestic operation, and smoke abatement.

The following list gives name of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, Room 5605 Grand Central Terminal building, New York.

AMERICAN RAILWAY ASSOCIATION DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago.

DIVISION V—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Next meeting, Chicago.

DIVISION VI—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.

AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet avenue, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor *Railway Mechanical Engineer*, 30 Church St., New York.

AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 7016 Euclid Ave., Cleveland, Ohio.

AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth street, New York.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting Hotel Sherman, Chicago, Oct. 22-25.

CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que. Next meeting October 14, 8 p. m., at Windsor Hotel. Immigration will be discussed by Col. J. S. Dennis, chief commissioner, Department of Colonization and Development, Canadian Pacific.

CAR FOREMEN'S ASSOCIATION OF CHICAGO.—G. K. Oliver, 7836 So. Morgan street, Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago, Ill. Next meeting October 14, 8 p.m.. Installation of officers and dance.

CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. G. Weigman, 720 North Twenty-third street, East St. Louis, Ill. Regular meeting first Tuesday in each month, except June, July and August, at Broadview Hotel, East St. Louis, Ill.

CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meetings second Friday of each month in the Pacific Electric Club building, Los Angeles, Cal.

CENTRAL RAILWAY CLUB.—Regular meetings second Tuesday each month, except June, July and August, at Hotel Statler, Buffalo.

CHIEF INTERCHANGE CAR INSPECTORS AND CAR FOREMEN'S ASSOCIATION.—See Master Car Builders' and Supervisors' Ass'n.

CINCINNATI RAILWAY CLUB.—D. R. Boyd, 3328 Beekman St., Cincinnati. Regular meeting second Tuesday, February, May, September and November.

CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meeting first Monday each month, except July, August and September at Hotel Hollenden, East Sixth and Superior Ave.

INTERNATIONAL RAILROAD MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.

INTERNATIONAL RAILWAY FUEL ASSOCIATION.—C. T. Winkless, Room 707, LaSalle Street Station, Chicago.

INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash street, Winona, Minn.

LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, 3212 Delachaise street, New Orleans, La. Meetings third Thursday in each month.

MASTER BOILERMAKERS' ASSOCIATION.—A. F. Stiglmeier, acting secretary, care of New York Central, 138 North Allen street, Albany, N. Y.

MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—A. S. Sternberg, master car builder, Belt Railway of Chicago, Chicago.

NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston. Next meeting October 8, 6:30 p.m. Paper on an American view of English transportation will be presented by Professor Kent T. Healy, Yale University.

NEW YORK RAILROAD CLUB—Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York. Mrs. M. E. Hartman, acting secretary, 26 Cortlandt street, New York.

PACIFIC RAILWAY CLUB.—W. S. Wollner, P. O. Box 3275, San Francisco, Cal. Regular meetings, second Tuesday of each month in San Francisco and Oakland, Cal., alternately. Next meeting October 11. The Newest Locomotive Economy Appliances will be discussed by William G. Tawse, service engineer of the Superheater Company, and V. Villet, service engineer of the Westinghouse Air Brake Company.

RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—See Master Car Builders' and Supervisors' Association.

RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meetings third Thursday of each month, except June, July and August.

RAILWAY CLUB OF PITTSBURGH.— J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Ft. Pitt Hotel, Pittsburgh, Pa.

ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, M. P. O. Drawer 24 St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.

SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meetings third Thursday in January, March, May, July, September and November. Annual meeting third Thursday in November, Ansley Hotel, Atlanta, Ga.

SOUTHWEST MASTER CAR BUILDERS' AND SUPERVISORS' ASSOCIATION.—See Master Car Builders' & Supervisors' Association.

TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio.

WESTERN RAILWAY CLUB.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

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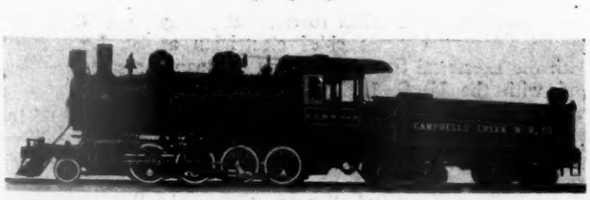

2-8-0 type locomotive with welded tender tank built for the Campbell's Creek by the Baldwin Locomotive Works in 1922

Tractive force, 32,600 lb.; 20-in. by 24-in. cylinders; 50-in. diameter drivers; boiler pressure, 200 lb.

Supply Trade Notes

HOWARD MULL, manager of railroad sales of the Warren Tool & Forge Company, Warren, Ohio has been promoted to vice-president.

PERRY W. OLLIVER, representative of the Sullivan Machinery Company at El Paso, Tex. has been promoted to manager of the San Francisco, Cal., office to succeed Ray P. McGrath, who died on August 25.

O. G. NEWMANN, formerly assistant manager of the Cincinnati, Ohio warehouse of the Jones & Laughlin Steel Corporation, has been appointed representative of the Inland Steel Company with headquarters at Chicago.

GEORGE R. HARRISON has been appointed Cleveland representative for the Reading Chain & Block Corporation, Reading, Pa. Mr. Harrison will have his headquarters at 362 Rockefeller building, Cleveland, Ohio.

AT A SPECIAL MEETING of the directors of the Independent Pneumatic Tool Company, Chicago, Ralph S. Cooper, first vice-president, was elected president to succeed John D. Hurley, who died on August 15. Neil C. Hurley was elected a member of the executive committee and Raymond J. Hurley was elected a director. Mr. Cooper graduated from Cornell University in 1903 with a degree in mechanical engineering and immediately entered the employ of the Independent Pneumatic Tool Company. After a year in the shop he became associated with the sales department and shortly after was promoted to manager of the New York office and then to eastern manager. In 1917 he was elected vice-president in charge of eastern sales and was transferred to Chicago in 1918 as vice-president and general sales manager. He spent 1920 and 1921 in Europe, opening the company's office in Great Britain and establishing Thor agencies throughout the continent. On his return to the United States in 1921 he also became general manager in charge of all departments of the company, which work he has carried on for the last eight years.

Ralph S. Cooper

E. T. WADE has been appointed representative of the Davis Brake Beam Company, Johnstown, Pa., for the South Atlantic states. Mr. Wade's office is at 1222 Mutual building, Richmond, Va.

BLAKE C. HOOPER has been appointed sales manager of the Baker Industrial Truck division of the Baker-Raulang Company, Cleveland, Ohio. Mr. Hooper will continue also to have charge of the company's railroad department.

THE JOHNS-MANSVILLE CORPORATION, New York, has completed arrangements with the Insulite Company, Minneapolis,

Minn., for the manufacture by the latter company of insulating lumber to be made to Johns-Mansville specifications for sale by Johns-Mansville in the territory west of the Allegheny mountains. No other arrangements with the Insulite Company or the United States Gypsum Company, Chicago, have been considered and the rumors of a probable merger at any time are wholly without foundation.

THE GENERAL ELECTRIC COMPANY will on October 1 consolidate its 14 wholesale distributing corporations into the General Electric Supply Corporation of Delaware. No change in ownership is involved, but the consolidated company will be able to supply equipment and apparatus through any one of 76 houses through the interchangeability of stocks. C. E. Patterson will be president and Gerald Swope, president of the General Electric Company, will be chairman.

F. B. CALDWELL, vice-president of the Chicago plant of the Link-Belt Company, has resigned on account of ill health. W. C. Carter, vice-president in general charge of production at all the company's plants, will assume the duties of vice-president and general manager of the Chicago plant. E. J. Burnell, manager of the Pittsburgh office, has been appointed sales manager of the Western division, with headquarters at the Chicago plant, and Nels Davis will succeed Mr. Burnell as manager of the Pittsburgh office.

H. PAUL CLEAVER has been appointed superintendent of the Philadelphia plant of the J. G. Brill Company, succeeding O. C. Kahler who resigned recently on account of ill health. Mr. Cleaver, after graduating as a mechanical engineer from the University of Delaware in 1918, became associated with the Harlan plant of the Bethlehem Shipbuilding Corporation, Wilmington, Del. In 1920 he was appointed general foreman of the car department, and the following year became assistant superintendent. In 1926 he left that position to join the engineering staff of the J. G. Brill Company and the following year was appointed general foreman. Early in 1929 he was appointed assistant superintendent and now becomes superintendent of the Philadelphia plant as above noted.

JOHN D. HURLEY, president of the Independent Pneumatic Tool Company, died suddenly on August 15. Mr. Hurley was born at Simsbury, Conn. After receiving his education at Galesburg, Ill., he entered railway service with the Chicago, Burlington & Quincy and was later in the employ of the Louisville & Nashville at Louisville, Ky. After this he took an active part in the building of railroads in Mexico. In 1898, he, with his brother Edward N. Hurley, Sr., organized the Standard Pneumatic Tool Company, which was one of the first concerns to introduce air tools in railroad shops and other industries. On March 1, 1902, this company was absorbed by the Schwab interests and Mr. Hurley became identified with the Rand Drill Company of New York. In 1905 he returned to Chicago and organized the Independent Pneumatic Tool Company.

John D. Hurley

THE CENTRAL ALLOY STEEL CORPORATION has completed the construction, and has started the operation of what is claimed to be the largest nitriding furnace in the world at its Canton, Ohio, works. The new furnace will be utilized to promote the use of nitralloy, one of the important new alloys being produced by the company under Krupp licenses. When case-hardened by the nitriding process, nitralloy becomes the hardest known steel surface. The nitriding process is applied after the metal has been fabricated into the finished part, and the company has placed the facilities of the new nitriding furnace at the disposal of manufacturers, who, at present, lack such equipment, enabling them to make tests with nitralloy before installing their own nitriding equipment, which is said to be a relatively simple process. Because of the size of the furnace, the company has been nitriding parts up to 23 ft. long, including such large pieces as crosshead guides for locomotives.

L. R. Gurley, associate editor of the Railway Age and the *Railway Mechanical Engineer*, has resigned to become editor of Welding, a new magazine to be published by the Steel Publications, Inc., Pittsburgh, Pa. Mr. Gurley is a graduate of the Altoona, Pa., high school. He entered the University of Pittsburgh in 1916, and after completing a four-year course in railway mechanical engineering he became a special apprentice at the Altoona shops of the Pennsylvania. He completed this three-year apprenticeship course in the spring of 1923, graduating as a motive power inspector and being placed in the office of F. E. Grimshaw, superintendent of motive power, at Pittsburgh. He continued in this capacity until he joined the editorial staff of the Railway Age and the *Railway Mechanical Engineer* on May 6, 1924. Mr. Gurley has been an active member of the American Welding Society for the past five years and is at the present time a member of the Revision of By-Laws Committee of the National Meetings and Paper Committee and second vice-chairman of the New York Section of the Society. He is also an associate member of the American Society of Mechanical Engineers and a member of the New York Railroad Club.

L. R. Gurley

ANNOUNCEMENT WAS MADE recently of the appointment of Don C. Wilson as assistant to the president of the E. A. Lundy Corporation with headquarters in New York and of the appointment of W. F. Bauer as western manager for the company with headquarters at Chicago. Mr. Wilson was educated in the Public Schools of Broken Bow, Neb., and the Nebraska State University, completing his course in electrical engineering in 1907, after which he engaged in electrical work with the Stone & Webster Construction Company at Seattle; the U. S. Navy Yard, Bremerton; the Pacific Gas & Electric Company, Los Angeles; the Independent Telephone Company, Omaha; the Union Pacific Railroad, Omaha; Central of Georgia at Savannah and the Delco Light Company of Chattanooga. In 1920 he became assistant sales manager for the Edison Storage Battery Company in charge of the railway department, later becoming general sales manager of that company which position he held at the time of his affiliation with the E. A. Lundy Company.

Mr. Bauer has had a wide railway experience with the Pullman Company as electrical foreman at Jersey City, N. J., with the Missouri Pacific as chief electrician at St. Louis, Mo., with the Electrical Storage Battery Company as sales engineer and with the U. S. Light & Heat Corporation as western railroad manager. Until recently he occupied the position of western railroad manager for the Edison Storage Battery Company. Mr. Bauer is past president of the Railway Electrical Supply Manufacturers' Association and is now president of the Railway Electrical Pioneers' Club. Mr. Bauer will have charge of the new offices of the E. A. Lundy Corporation recently opened at 1809 Engineering building, Chicago.

Trade Publications

Copies of trade publications described in the column can be obtained by writing to the manufacturers. State the name and number of the bulletin or catalog desired, when mentioned in the description.

ENGINE INDICATORS.—Recent developments in the line of Maihak engine indicators are described and illustrated in Bulletins 1262, 1263 and 1264 issued by the Bacharach Industrial Instrument Company, 7,000 Bennett street, Pittsburgh, Pa. These indicators are for Diesel, gas and steam engines; ammonia compressors and pumps; for speeds up to 2,200 r.p.m., and for pressures up to 5,000 lb.

LATHES.—"The Proper Machine for the Job" is the title of an unusual booklet issued by the Jones & Lamson Machine Company, Springfield, Vt. The booklet is so designed as to hold within its folds a number of half-tone illustrations of Jones & Lamson machines, each of the illustrations being in loose-leaf form and giving a brief description of the outstanding features of each machine.

MACHINERY AND TOOLS.—An attractive leather-bound catalogue, No. 139, has been issued by the Brown & Sharpe Manufacturing Company, Providence, R. I. This general catalogue contains complete listings of milling, grinding, screw and gear cutting and hobbing machines and attachments, also a listing of tools, arbors, cutters, etc., similar to that contained in Small Tool Catalogue No. 31 prepared especially for mechanics and others interested primarily in machinists' tools.

AMERICAN STEEL FOUNDRIES' DEVELOPMENTS.—The contributions of the American Steel Foundries in the way of research and development of railroad products from 1894 to 1929, or covering a period of 35 years, are outlined in a highly interesting and unusually attractive 35-page booklet recently issued by this company. The booklet is replete with illustrations of research and testing equipment as applied to railroad products, and the subject matter is presented in such a way as to hold the interest throughout. It is divided into six sections covering the development of the cast steel bolster and truck side frame; the Davis steel wheel; a roller bearing truck wheel unit; quality springs and brake beams; the automatic coupler; and a section on the facilities for general research and development work.

* * *

750-hp. oil-electric freight locomotive built for service on the Putnam Division, New York Central by the Ingersoll Rand and General Electric Companies

Personal Mention

General

JAMES GRANT, shop superintendent of the Atlantic Coast Line at Tampa, Fla., has been appointed superintendent of motive power, with headquarters in the same city, succeeding James Paul.

F. W. SCHULTZ, mechanical superintendent of the Kansas City, Mexico & Orient, has been appointed superintendent of shops of the Atchison, Topeka & Santa Fe, with headquarters as before at Wichita, Kan.

F. P. PFAHLER, assistant to the chief of motive power and equipment of the Seaboard Air Line, has been appointed to the newly created position of assistant to the general superintendent of motive power, with headquarters at Savannah, Ga.

E. H. ROY, master mechanic of the South Carolina division of the Seaboard Air Line, has been appointed superintendent of motive power of the Northern district, with headquarters as before at Savannah, Ga., succeeding C. S. Patton.

G. G. LYNCH, assistant mechanical engineer of the Atlantic Coast Line, with headquarters at Wilmington, N. C., has been appointed mechanical engineer-equipment, with headquarters in the same city.

F. R. MAYS, general superintendent of the Yazoo & Mississippi Valley with headquarters at Memphis, Tenn., has been appointed general superintendent of motive power of the Illinois Central with headquarters at Chicago, succeeding R. W. Bell, who has resigned.

JAMES PAUL, superintendent of motive power of the Atlantic Coast Line at Tampa, Fla., has been appointed general superintendent of motive power, with headquarters at Wilmington, N. C. Mr. Paul was born at Lanarkshire, Scotland, in 1869. He entered railroad service in 1885 with a predecessor of the Atlantic Coast Line as car inspector's helper. He was later transferred to the machine shop as an apprentice. Upon the completion of his apprenticeship, Mr. Paul served successively as air brake repairman, enginehouse foreman and general foreman. In 1906 he became master mechanic; in November, 1925, was promoted to the position of assistant superintendent of motive power, and in March, 1927, appointed superintendent of motive power.

Shop and Enginehouse

W. P. THRUNE, enginehouse foreman of the Chicago, Burlingon & Quincy at La Crosse, Wis., has been promoted to the position of general foreman, with headquarters at Kansas City, Mo.

WALTER M. MEDLOCK, enginehouse foreman of the St. Louis-San-Francisco, has been promoted to the position of general foreman, locomotive department, with headquarters at Kansas City, Mo., succeeding J. D. Knox, deceased.

D. R. DAVIS, enginehouse foreman of the Chicago, Milwaukee & St. Paul at Montevideo, Minn., has been promoted to the position of general foreman, locomotive department, with headquarters at Kansas City, Mo.

Master Mechanics and Road Foremen

GEORGE MOLL, road foreman of engines of the Wilmington and Columbia division of the Reading, has been retired after fifty-four years' service.

PETER C. CASSIDY has been appointed road foreman of engines of the Wilmington and Columbia division of the Reading, succeeding George Moll.

F. W. BUCKPITT, assistant superintendent of shops of the Boston & Maine at Billerica, Mass., has been promoted to the position of master mechanic of the Fitchburg division, with headquarters at Greenfield, Mass. Mr. Buckpitt was born on March 17, 1887, at Sarina, Ont., and received a high school education. He entered railroad service in January, 1904, as a machinist apprentice on the Grand Trunk at Port Huron, Mich. From 1908 until 1909 he was a machinist in the locomotive shops of the United States Steel Corporation, Chicago, and for the following three years was enginehouse foreman of the Elgin, Joliet & Eastern at Gary, Ind. From 1912 until 1914 he served as enginehouse foreman of the San Antonio & Arkansas Pass at Kenedy, Tex., returning in the latter year to the employ of the United States Steel Corporation at Gary, Ind., as locomotive shop foreman. He went overseas in 1917 and upon his return in 1919 accepted the position of mechanical foreman of the Youngstown Sheet & Tube Company, Indiana Harbor, Ind. He remained in that position until 1924 when he entered the employ of the Chicago Junction as a machinist and chief piecework inspector at Chicago. Mr. Buckpitt was appointed assistant superintendent of shops of the Boston & Maine at Billerica in 1927.

Car Department

M. A. WILLIAMSON has been appointed car foreman of the O. W. R. R. & N. unit of the Union Pacific, with headquarters at Umatilla, Ore.

M. J. MCCAFFREY, general car foreman of the St. Louis-San Francisco at Springfield, Mo., has been transferred as general car foreman to Kansas City, Mo.

J. C. EKAS, foreman passenger car department, of the Atchison, Topeka & Santa Fe at Topeka, Kans., has been promoted to the position of general foreman, freight car department.

Purchases and Stores

SAMUEL SNEDDON, district storekeeper of the Canadian National at Winnipeg, Man., has been transferred to Toronto, Ont., to succeed J. H. Brown.

CHARLES S. ARGYLE, district storekeeper of the Canadian National at Saskatoon, Sask., has been transferred to Edmonton, Alta., succeeding S. E. Keillior.

STEWART E. KEILLOR, district storekeeper of the Canadian National at Edmonton, Alta., has been transferred to Winnipeg to succeed Samuel Sneddon.

CHARLES B. WRIGHT, storekeeper of the Canadian National at Point St. Charles, Que., has been promoted to district storekeeper at Saskatoon, Sask., succeeding C. S. Argyle.

C. W. KINNEAR, assistant general storekeeper of the Pennsylvania at Altoona, Pa., has been appointed assistant general storekeeper, with headquarters at Philadelphia.

H. L. TAYLOR has been promoted to purchasing agent of the Western region of the Canadian National with headquarters at Vancouver, B. C.

J. H. BROWN, district storekeeper of the Canadian National at Toronto, Ont., has been promoted to assistant general storekeeper of the Atlantic region, with headquarters at Moncton. N. B.

W. E. F. KIRK, division storekeeper of the Atchison, Topeka & Santa Fe at Ottawa, Kan., has been promoted to general lumber supervisor at Topeka, Kan.

A. B. SEARS, storekeeper of the Atchison, Topeka & Santa Fe at Waynoka, Okla., has been appointed division storekeeper with headquarters at Ottawa, Kan.

MONTGOMERY SMITH, assistant general purchasing agent of the Pennsylvania, with headquarters at Philadelphia, has retired from active duty under the company's pension regulations.

W. E. WILFORD, assistant purchasing agent of the Ontario district of the Canadian Pacific, has been promoted to purchasing agent of that district, with headquarters as before at Toronto, Ont.

HAROLD WILSON, chief clerk to the assistant to the president of the Union Pacific, has been promoted to the position of assistant to the general purchasing agent, with headquarters at Omaha, Neb.

F. W. MAHL, general purchasing agent of the Southern Pacific, with headquarters at San Francisco, Cal., after more than thirty years of service, has been granted a leave of absence pending retirement. The jurisdiction of F. W. Taylor, purchasing agent at San Francisco, has been extended to cover activities heretofore handled by the general purchasing agent.

GEORGE C. SMITH, purchasing agent of the Union Pacific, with headquarters at Omaha, Neb., retired from active duty on July 1, at the age of 70 years, after 43 years of continuous service with that railroad. The position of purchasing agent of that unit of the system has been abolished and those duties will be taken over by the general purchasing agent of the system.

Obituary

NATHANIEL M. RICE, vice-president in charge of purchases and stores of the New York, New Haven & Hartford, with headquarters at New Haven, Conn., died at a hospital in that city on September 4. Mr. Rice, who had been on a leave of absence on account of ill health since early in June, was born on December 28, 1863, at Rome City, Ind., and was educated in the public schools of that city. He entered railway service in May, 1887, as a brakeman on the Gulf, Colorado & Santa Fe, later serving in several positions in the transportation and stores department of the same road. From April, 1901, to April, 1903, he was assistant general storekeeper of the Atchison, Topeka & Santa Fe, Coast Lines. He was then appointed general storekeeper in charge of material, fuel and stationery. On November 13, 1913, he was appointed general purchasing officer of the St. Louis-San Francisco, with headquarters at St. Louis, Mo. From 1915 to 1916 he was third vice-president in charge of purchases, and from 1916 to 1919, second vice-president of the same road. Mr. Rice served as vice-president of the Pierce Oil Corporation from 1919 to 1920, then becoming general purchasing agent of the New York, New Haven & Hartford and also of the Central New England and New England Steamship Company. In June, 1927, Mr. Rice was promoted to the position of vice-president in charge of purchases and stores.

Nathaniel M. Rice